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EVALUATION OF DIFFUSION COEFFICIENTS FOR STRONTIUM IN BUFFER MATERIALS

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ABSTRACT

A series of diffusion experiments were conducted on six mixtures of Pembina bentonite and silica sand to, first, provide quantitative data for the evaluation of Pembina bentonite as a buffer material; second, determine the effect of bulk density and clay content on measured diffusion coefficients: and third, evaluate the applicability of using a representative retardation factor coupled with the free-solution diffusion coefficient and tortuosity factor to estimate the effective diffusion coefficient for a reactive solute in a porous media. In general, the experimental diffusion coefficients for strontium were significantly affected by the bulk-density and water-content conditions with values decreasing from an average of 6×10^{-7} cm^2s^{-1} to 5×10^{-8} cm^2s^{-1} under 'low' and 'high' bulk-density conditions respectively. However, an increase in clay content of the buffer material in excess of 10% to 25% did not result in a noticeable decrease in the diffusion coefficient within each bulk-density category. In addition, strontium diffusion coefficients were found to become increasingly sensitive to small changes in the bulk density to water-content ratio as the clay content was increased. A comparison of calculated versus experimental strontium diffusion coefficients showed fairly good agreement, however, it was found that great care must be taken in obtaining both the distribution coefficient and tortuosity values required by the calculation procedure.

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EVALUATION OF DIFFUSION COEFFICIENTS FOR STRONTIUM IN BUFFER MATERIALS

1. INTRODUCTION

The Canadian program for the management of nuclear fuel waste has concentrated on a multiple barrier system in crystalline rock. It is proposed that buffer materials, which are considered as part of this barrier system, be placed directly around the radioactive waste canisters. The buffer will be required to fulfill several functions, one of which is to inhibit the mass transport of solutes in the vicinity of the waste package (Bird and Cameron /1/).

Physical arguments indicate that in fine-textured materials such as those proposed for use as buffers, the principle mechanism of solute migration will be molecular diffusion (Gillham and Cherry /2/). In this case, the more general transport equation, which accounts for both advection and dispersion, reduces to a diffusion equation. For a porous medium, this equation can be written:

$$\frac{\partial C}{\partial t} + \frac{\rho}{n} \frac{\partial q}{\partial t} = D_m \frac{\partial^2 C}{\partial x^2} \tag{1}$$

where C is the concentration of the solute in solution; D_m is the molecular diffusion coefficient in the soil; x is the Cartesian space coordinate; t is time; q is the concentration of the solute on the solid phase; n is the porosity; and ρ is the bulk density of the porous medium. If the relationship between q and C is linear, reversible and non-hysteretic, Equation (1) can be rewritten as:

$$\frac{\partial C}{\partial t} = D_s \frac{\partial^2 C}{\partial x^2} \qquad (2)$$

where D_s is the effective diffusion coefficient of a reactive solute in the medium. D_s is defined by:

$$D_s = \frac{D_m}{1 + (\rho/n)Kd} \qquad (3)$$

where Kd is the distribution coefficient and collectively the denominator is referred to as the retardation factor (R).

For nonreactive solutes, D_m in Equation (3) is considered to be related to the diffusion coefficient of the solute in free solution (D_o) by a tortuosity factor (τ), ie:

$$D_m = D_o \tau \qquad (4)$$

Therefore Equation (3) may be rewritten as:

$$D_s = \frac{D_0 \tau}{1 + (\frac{\rho}{n})Kd} \qquad (5)$$

For a more detailed development of these concepts the reader is referred to Gillham et al./3/

In applying Equation (2) D_s can be measured experimentally under the conditions anticipated in the field. For solutes that are highly retarded however, these measurements can be difficult and time consuming. Alternatively, D_s can be calculated by determining its components according to Equation (5). The applicability of using calculated diffusion coefficients for predictive purposes is still uncertain; however, results of work described in Gillham et al./3/ on a variety of sand /Na-bentonite mixes, using Sr^{85} as the reactive solute, indicate that this method of determining effective diffusion coefficients for reactive solutes is very promising. The experimental conditions however were limited to a consideration of very low values of bulk density; values much lower than expected in the actual buffer materials. Additional research was therefore needed to evaluate the usefulness of Equation (5) under various experimental conditions.

As part of Ontario Hydro's Technical Assistance Program (TAP) to AECL, a co-operative research program between the Institute for Groundwater Research, University of Waterloo, and the Civil Research Department, Ontario Hydro Research Division was developed to address this problem and to provide quantitative data for the evaluation of candidate materials for use as buffers.

This report presents the results of the first phase of the program which pertains specifically to the use of the candidate buffer material Pembina bentonite, and Sr^{85} as the reactive solute. Specific objectives of the study were:

1. to determine Sr adsorption isotherms for Pembina bentonite and silica sand mixes
2. to evaluate the relationship between clay content and Kd values
3. to measure Sr diffusion coefficients for a variety of Pembina bentonite/ sand mixes
4. to determine the effect of bulk density and clay content on measured diffusion coefficients
5. to evaluate the applicability of Equation (5) under the experimental conditions studied.

2. MATERIALS AND METHODS

2.1 POROUS MEDIA

The porous media used in this study consist of Pembina bentonite and graded silica sand mixtures of 100, 75, 50, 25, 10 and 0 percent bentonite. For a detailed description of the physical and chemical properties of these materials, the reader is referred to Quigley /4/. A summary of the properties relevant to this investigation is given in Tables I and II (a) and (b). The average particle densities (calculated) and the measured air-dry gravimetric water contents of the mixtures are given in Table III. All water-content determinations were performed by oven drying at 105° C for 24 hours.

2.2 STRONTIUM ADSORPTION ISOTHERMS

Adsorption isotherms for the bentonite/sand mixtures were determined by equilibrium batch methods. Two sets of adsorption experiments were performed. In the first test, using only the 50% bentonite sample, the effect of the soil to solution ratio on Kd values was examined. The second set of experiments determined strontium distribution coefficients for each of the bentonite/sand mixes over four equilibrating solution concentrations 10^{-4}, 10^{-6}, 10^{-8} and 10^{-10} M. The soil to solution ratios were chosen to be representative of the conditions in the low-density diffusion experiments (Table III) and an equilibration time of four days was used.

In both sets of experiments, the necessary equilibrating solutions were prepared by the serial dilution of stable Sr^{88}, in the form of $SrCl_2 6H_2O$, with deionized water. To these solutions, trace quantities of radioactive Sr^{85} (10^{-12} M) were added to allow for radiometric analyses. All analyses were performed in triplicate and, in order to evaluate the reproducibility between laboratories, the Kd determinations were performed by both Ontario Hydro and the University of Waterloo.

Due to the low solution-to-solid ratios used in the batch tests, the natural moisture content of the air-dried samples had to be accounted for. The moisture content of each soil mixture was therefore determined prior to mixing with the equilibrating solutions. The appropriate amount of solution was then added to the air-dried bentonite/sand mixes such that the natural water content plus the added equilibrating solution was equal to that required to maintain the solution:solid ratios listed in Table III.

The solution-soil mixtures were equilibrated for four days in disposable polypropelene beakers which were sealed with parafilm to prevent moisture loss. The samples were stirred twice daily during the equilibration time. After four days the soil samples were transferred to disposable centrifuge tubes and centrifuged at approximately 3350 rpm (RCF 1750) for 20 to 30 minutes or until at least 2 to 3 mL of supernatant had accumulated. The supernatant was then removed using a disposable hypodermic syringe. Once the supernatant was extracted, the needle was replaced with a polycarbonate filter holder equipped with a 0.45 µm membrane filter and the solution expelled into a polypropelene counting vial. A 1 or 2 mL aliquot of the filtered solution was then transferred to the counting vial using a 1000 µL micro pipette. The University of Waterloo samples were counted on a Nuclear-Chicago dual channel automatic gamma counter (model 1085). At Ontario Hydro, 15 mL of Amersham PCS scintillation cocktail were added to glass scintillation vials containing the filtered soil solution and the samples were counted on a Searle Mark III liquid scintillation system (model 6880).

The Sr^{85} activity obtained was expressed as counts per minute and compared to the activity of an equal volume of the initial equilibrating solutions, corrected for dilution by natural soil moisture. The difference in activity was taken to be equal to the activity associated with the solid phase. Kd values were obtained from:

$$Kd = \frac{(\frac{Co}{DF}) - C}{C} \quad \frac{V_T}{M} \qquad (6)$$

where

$$DF = \frac{V_A + V_M}{V_A} = \frac{V_T}{V_A} \qquad (7)$$

and

Co = the activity in the initial equilibrating solution (counts per minute per mL)

C = the activity in the equilibrated soil solution (counts per minute per mL)

DF = dilution factor

V_T = total volume of solution associated with the solid phase (mL)

V_A = volume of solution added to solid phase (mL)

V_M = natural moisture content of air-dried solid phase (mL)

M = oven-dry mass of soil used (g)

2.3 MEASUREMENT OF DIFFUSION COEFFICIENTS

In the diffusion experiments a one-dimensional closed diffusion system was used. The system consisted of two half-cells; one half-cell contained soil in equilibrium with a deionized water solution containing the radioactive tracer while the other half-cell contained the same soil in equilibrium with deionized water only. The soils in the two cells were placed in contact with each other and at the end of the diffusion period the cells were separated, the soil cores partitioned and the distribution of the tracer was determined by radio-assay procedures.

The diffusion experiments were performed using three radioactive tracers; Sr^{85}, H^3, and Cl^{36}, and three categories of bulk density; 'low', 'medium', and 'high'. The range of densities associated with each category and the corresponding solution-to-solid ratios are given in Table IV. Initial estimates of the moisture values were based on the theoretical standard Proctor curve for a saturated sample having a specific gravity of 2.69 (Figure 2). The values given in Table IV are the actual densities and moisture contents obtained under the experimental conditions. The low and medium density diffusion experiments were conducted jointly at both the Ontario Hydro and the University of Waterloo laboratories while the high density tests were conducted at the University of Waterloo. All diffusion tests were performed in duplicate.

For each soil mix and bulk density, the appropriate amount of tracer solution in the case of the tagged half-cell or deionized water in the case of the untagged half-cell, was added to the air-dried soil mix to obtain the total moisture contents as outlined in Table IV. Prior to packing, the wet soils were allowed to equilibrate in polyethelene, screw-cap containers for 14 days for the low- and medium-density tests, and for 7 days for the high density tests. During the equilibrium time the 'tagged' and 'untagged' soil mixtures were stirred twice daily.

A diagram of the diffusion cell used for the low- and medium-density diffusion experiments is shown in Figure 3. Each half-cell consisted of a 50 mL disposable polyethylene syringe with its needle-end cut off at a distance of approximately 5.5 cm away from the finger grips. A snuggly fitted teflon plug, approximately 6 mm thick, was inserted and positioned at the finger grip end and mounted onto a holding device (Figure 4). The half-cell was then packed with the appropriate equilibrated soil mixture.

The low-density half-cells were packed by tapping the cell gently as small amounts of wet soil were added. The tapping procedure evenly distributed the wet soil in the cell and allowed any trapped air to escape. Due to the more cohesive nature of the medium-density mixes, the packing procedure was modified. The 10% and 25% mixes were packed manually using a teflon piston to lightly tamp the material as it was added to the cell. The medium-density cells for the higher percentage bentonite mixtures were packed with the aid of a hydraulic press. For this process, the wet soil was packed in one lift. An adapter was fitted to the top of the half-cell to hold the required amount of unpacked soil. To allow any trapped air to escape, slits were cut in the lip of the syringe located at the finger grip end. The cells were then pressed until the wet soil inside the half-cell turned uniformly dark in colour (indicating saturation).

For a given low- or medium-density diffusion cell, two half-cells were packed; one with the buffer mix containing the tracer, and the other with the tracer-free soil. The half-cells were overfilled slightly to ensure complete contact at the interface when the cells were joined. As pressure was applied in joining the two half-cells, this excess material was allowed to escape. When the contact surface of the two half-cells was flush, a clamping device similar to that employed by Gillham et al./3/ was used.

To prevent, or at least minimize moisture loss, Dow Corning high vacuum silicon grease was applied as a sealant around the outside of the teflon plug and at the interface. The assembled diffusion cells were then repeatedly submerged in molten parafin. The waxed cells were stored horizontally at $25^{\circ} \pm 1^{\circ}$ C in a constant temperature box at 100% relative humidity conditions.

After the prescribed diffusion time had elapsed, the diffusion cells were separated and the soil cores sectioned. Each cell was first stripped of its parafin coating and the clamp holding the two half-cells together was then loosened slightly to allow the insertion of a thin spatula at the interface between the two half-cells. The clamp was then removed completely, and the two half-cells were slid apart along the spatula. One of the two half-cells was then covered with parafilm to prevent drying and the other was mounted on the sectioning device illustrated in Figure 5.

The soil core was extruded from the half-cell by pushing the teflon plug with the aid of a calibrated screw. The soil core was extruded in 3 mm (Ontario Hydro) or 5 mm (University of Waterloo) lengths and was sectioned flush with the edge of the half-cell. The soil section was transferred to a glass scintillation vial and the moisture content determined by oven-drying for 24 hours at 105° C.

At the University of Waterloo laboratory, the oven-dried soil was transferred to a counting tube, and 5 mL of deionized water was added. The soil-water mixture was then shaken and allowed to equilibrate 24 hours. Since all of the samples had approximately the same amount of soil, it was felt that that geometry of the sample was sufficiently constant for radiometric analysis. The samples were therefore counted for 20 minutes on an automatic gamma counter.

At Ontario Hydro, after the moisture content had been determined, 10 mL of 20% HCl were added to the scintillation vial to extract the strontium from the dry soil section. The acid/soil mixture was allowed to equilibrate 24 hours and 2 mL of the supernatant was submitted for scintillation counting.

For the high-density diffusion cells, the soil mixtures were packed hydraulically in a stainless-steel compaction mold as depicted in Figure 6. The packing mold consisted of a thick-walled stainless-steel cylinder fitted at each end with a retaining plate. The top plate was equipped with an opening of the same internal diameter as that of the cylinder in order to allow passage of a stainless steel piston. The bottom plate contained small vents to allow trapped air to escape during the packing procedure. A stainless steel screen and filter paper were placed between the end-plate and the cylinder to prevent the soil from plugging the air vents. It was later found that the air vents were superfluous and that air could escape using the screen system only.

To pack a half-cell, the stainless steel cylinder was filled to the top with loose soil. A tight-fitting teflon plug about 1 cm long was then inserted at the top of the cylinder and pushed down with the piston of the hydraulic press. The purpose of the teflon plug was to prevent soil grains from being caught between the piston and the inside of the cylinder wall. The hydraulic press was operated intermittently with one or two minutes between pumping stages to allow the air to escape at the bottom of the cylinder.

The piston was advanced until a pressure of 41370 kPa (6,000 psi) was reached. This pressure was maintained for approximately five minutes. The mold was then dismantled and the cylinder turned upside down. Another teflon plug was inserted and the soil core repacked from this end in the same manner as previously described. This reversed packing procedure was used to minimize the possibility of density variations within each soil core. The soil core, being in itself a half-cell, was then removed from the compaction mold, wrapped in cellophane and allowed to equilibrate for 7 days in the constant temperature box.

After the equilibration period, the soil cores (half-cells) were trimmed to 3.5 cm in length. The tagged half-cell was then joined to the corresponding untagged half-cell. To provide a good contact surface between the tagged and untagged half-cells, a paste of 100% Pembina bentonite (untagged) was applied to the interface. The two half-cells were then pressed together and the excess bentonite paste was allowed to escape. The high density diffusion cell, thus assembled, was wrapped in cellophane, inserted into a snuggly-fitted plastic tube for protection, teflon plugs inserted at each end, and the unit clamped securely together as shown in Figure 7. The cells were then coated with parafin and replaced in the constant temperature box for the diffusion time period.

In sectioning the high density cell, a guillotine-like device was used (Figure 8). Because the interface was difficult to discern, sectioning proceeded progressively from the originally untagged portion of the cell. The first and last five sections were cut 3 mm thick while the middle 20 slices were 2 mm thick. The soil slices were transferred to glass scintillation vials and moisture contents determined in the manner described in the low- and medium-density diffusion tests. Ten mL of 20% HCl were added to the vials, the soil/acid mix shaken and allowed to equilibrate for several hours. The mixture was then centrifuged and a 5 mL aliquot of supernatant was submitted for gamma counting.

A preliminary analysis of the supernatant solution revealed very low count rates (cpm). The samples were therefore counted for 100 minutes and the number of samples analysed was reduced. Standards were also prepared from the equilibrated soil used to pack the reactive half-cells following the same procedure as described for the soil core slices. The very low concentrations were attributed to a different batch of Sr^{85} stock solution used in the high density cells than in the low- and medium-density cells. The concentration of this stock solution was found to be about 10 times lower, indicating a possible error in the preparation of the solution.

The procedures used in the diffusion experiments using the nonreactive tracers Cl^{36} and H^3 were similar to those previously described for Sr^{85} with the following modifications. The equilibration time of the solution and solid phases prior to packing the half cells was four days. After the packed half-cells were joined and the solute allowed to diffuse for the desired length of time, the half cells were separated, sectioned into 3 or 4 mm sections and soil slices were placed in polypropelene culture tubes. After weighing, a few sections from each cell were dried to determine the water content and as a result of the volatile nature of H^3, the sections could not be used for counting purposes. To the remaining sections, 3 to 5 mL of deionized water were added and the water/soil mixtures placed on a wrist-action shaker and allowed to equilibrate overnight. The samples were then centrifuged, 2 mL of the supernatant were placed in polyethelyne scintillation vials to which 3 mL of Aquasure high performance liquid scintillation cocktail were added and the solutions were counted on a Beckmann LS133 scintillation counter.

The diffusion experiments under 'low' and 'high' density conditions were conducted for the 10, 25, 50, 75 and 100% bentonite mixtures. Medium density experiments were carried out only on the 50% bentonite sample and only the 'low' density diffusion tests were performed on the 0% bentonite (100% silica sand) sample. All tests were conducted in duplicate.

Estimates of the termination time for all of the diffusion tests were obtained from (Crank /5/):

$$C\ (x,t) = (Co/2)\ \mathrm{erfc}\ [x/2\sqrt{Dt}\ ] \qquad (8)$$

where

C = the concentration of the diffusing solute at time and a distance x from the interface

Co = the initial concentration in the tagged half cell

erfc = complimentary error function

D = diffusion coefficient

Values of D for use in Equation (8) were obtained from Equation (5) using a tortuosity value of 0.67, molecular diffusion coefficients in free solution at 25^{0} C (Do) of 7.94×10^{-6} $cm^{2}.s^{-1}$ for strontium, 2.03×10^{-5} $cm^{2}.s^{-1}$ for Cl^{36} and 9.31×10^{-5} $cm^{2}.s^{-1}$ for H^{3} (Li and Gregory /6/). Equation (8) was then solved for time (t) for C/Co = 0.01 at a distance (x) equal to 2/3 of the length of the half-cell. Depending on the soil mixture and the bulk density, diffusion times varied between 2 and 90 days.

For soil sections obtained from the diffusion cells, the bulk density (ρb), gravimetric (ϕg) and volumetric (ϕv), water contents, porosity (η), percent saturation (by volume) and relative tracer concentration (C/Co) were calculated. These results, along with their corresponding mean values for each diffusion cell are listed in Appendix C for strontium. For the Cl^{36} and H^3 tests, C/Co values plus the mean values of the above parameters are given in Appendix B.

The relative concentration was calculated in terms of counts per minute per gram of oven-dry soil. For the low- and medium-density strontium diffusion cells, Co values were obtained by mass balance. In this method, Co is the total number of counts per minute in the entire diffusion cell divided by the amount of oven-dry soil in the 'tagged' half-cell and is given by:

$$C_o = \left(\sum_{i=1}^{n} C_i g_i\right) / \left(\sum_{i=1}^{n_t} g_i\right) \qquad (9)$$

where

n = total number of sections in the diffusion cell

n_t = number of sections in the tagged half-cell

C_i = number of counts per minute per gram of oven-dry soil in the i^{th} section

g_i = mass of oven-dry soil in i^{th} section.

Since not all of the soil slices were analysed for the high density strontium experiment and the Cl^{36} and H^3 tracer tests, the mass balance approach could not be used. In the case of Sr,Co was determined by equating C/Co = 0.5 to the concentration at the interface of the tagged and untagged half-cells (x=0). Co values were obtained by direct analysis of a soil sample used in the active half-cell for the Cl^{36} and H^3 tracer tests.

The diffusion equation applicable to the geometry of the diffusion experiments used in this study was given previously by Equation (2). The solution of Equation (2), subject to the initial condition:

$$C\ (x,o) = C_0 \quad , \qquad -\infty < x < 0 \qquad 10\ (a)$$

and

$$C\ (x,o) = o \quad , \qquad 0 < x < \infty \qquad 10\ (b)$$

was given by Equation (8). Although Equation (8) is based on a medium of infinite length it is also valid for the finite case where x extends from -L to +L as long as no ion movement at the boundaries takes place. In all of the strontium diffusion experiments, no diffusion at the outer ends of the soil core occurred and therefore Equation (8) was used to determine values of D_{obs}.

In the Cl^{36} and H^3 tracer experiments however, diffusion progressed to the outer boundaries and therefore Equation (8) was not applicable. In this case, for a porous medium of length L, the initial and boundary conditions are:

$$C\ (x,o) = C_o \quad , \qquad o < x < x_o \qquad 11\ (a)$$

$$C = o \quad , \qquad x_o < x < L, \qquad 11\ (b)$$

and

$$\frac{\partial c}{\partial x} = o \qquad x = o \text{ and } x = L \qquad 11\ (c)$$

The solution to Equation (2) is then (Carslaw and Jaeger /7/):

$$C/C_o = \frac{xo}{L} + \frac{2}{\pi} \sum^{\infty} \frac{\exp}{n} \left(-\frac{D\ n^2\ \pi^2\ t}{L^2}\right) \cos \left(\frac{n\ \pi\ x}{L}\right) \sin \left(\frac{n\ \pi\ xo}{L}\right) \qquad (12)$$

The observed diffusion coefficient values were determined by a trial-and-error adjustment of D until the solution (Equation 8 or 12) gave the best fit to the measured diffusion profiles.

3. RESULTS AND DISCUSSION

3.1 STRONTIUM DISTRIBUTION COEFFICIENTS

The Kd values determined from the equilibrium batch experiments for strontium are shown in Table V and are plotted versus percent Pembina bentonite in Figure 9. The distribution coefficients listed are the mean and standard deviations of the point values of the distribution curves which were found to be linear over the concentration range studied (Appendix A).

As anticipated, the general trend observed by both Ontario Hydro (OH) and the University of Waterloo (UW) was an increase in the Kd value for each clay content. The mean Sr Kd value for each clay content, including the respective error bars, are shown in Figure 9. Although the results from both laboratories were consistent and linear, as demonstrated by the high correlation coefficients ($r = 0.9957$ and 0.9868 for OH and UW results respectively), the UW Kd's were approximately twice as large as those determined by Ontario Hydro. The mean Sr Kd values varied from 0.31 to 9.15 $mL.g^{-1}$ and from 0.06 to 4.69 $mL.g^{-1}$ for UW and OH respectively.

The reason for this discrepancy is unknown however it is likely the result of small variations in laboratory procedures and techniques. In light of the highly sensitive nature of distribution coefficients to changes in physical and chemical parameters, this difference between laboratory results is not considered to be excessive.

Considering the high CEC value determined for Pembina bentonite (136 meq 100 g^{-1}, Table IIa) the Sr Kd values were not as large as one might anticipate. This is probably the result of the acidic nature of the clay (soil:water paste pH=3.4). The high concentration of H^+ would act as a strong competitor of exchange sites, reducing the adsorption of Sr^{2+}.

The Kd results of Figure 9 and Table V were obtained at the same values of water content as those used in the low bulk density diffusion experiments.

The effect of decreasing solution to solid ratios on measured Sr Kd values for the 50% Pembina bentonite sample is given in Table VI and in Figure 10. Regression analysis indicated that the Sr Kd is highly correlated to gravimetric water content, with a correlation coefficient of 0.9938. A regression line fitted to the data gave the relation:

$$y = 1.16x + 3.19 \tag{13}$$

where x is the gravimetric water content (g H_2O.gsoil $^{-1}$) and y is the Sr Kd value (mL.g^{-1}). This trend of decreasing Kd values with decreasing solution-to-soil ratios is most probably due to an increase in the concentration of competing ions in the solution phase as the relative amount of solids increase. This increase in cation concentration is probably caused by the redissolution of precipitated salts and a redistribution of exchangeable ions.

The results of this experiment demonstrates the necessity of duplicating actual or anticipated field conditions in laboratory adsorption experiments. Unfortunately, the centrifuge available for use in the batch experiments did not allow for the extraction of porewater at the lower solution-to-soil ratios used in the 'medium' and 'high' density experiments. As a result, Sr Kd values were not obtained for the lower water content diffusion experiments. Therefore, for the purposes of calculating Sr diffusion coefficients for the 'medium' and 'high' density experiments, Sr Kd values obtained from batch experiments performed at water contents equivalent to condition in the 'low' density diffusion experiments were used.

If linearity is assumed, then the Kd values at the lower water contents of the medium- and high- bulk density diffusion experiments can be obtained from an extrapolation of the regression line of Figure 10. Furthermore, if the slope of the regression line is assumed to be independent of the clay content, then the Kd values measured for all the soil mixtures can similarly be extrapolated to lower values of θ_g (higher values of bulk density), as demonstrated in Figure 11. In following this procedure, it was found that the average difference in Kd between the measured values (low bulk density) and those obtained by extrapolation at the 'medium' and 'high' bulk density values, was 11% and 16% respectively. In view of the possible sources of error in the final results and the questionable validity of the linear extrapolation and constant slope assumptions, these differences were not considered to be large. As a result, for obtaining calculated diffusion coefficients, it was decided to use the experimentally measured Kd values, (low bulk density) for all three bulk densities used in the diffusion experiments.

3.2 TORTUOSITY FACTORS

The tortuosity factors (τ) were determined from the results of the chloride and tritium diffusion experiments. The factors were calculated for each diffusion cell as the ratio of the experimental diffusion coefficient of the solute (D_{obs}), to the molecular diffusion coefficient of the solute in free solution (Do) according to Equation (4). The values of Do used in the calculation were 2.03×10^{-5} $cm^2 s^{-1}$ for Cl^{36} and 9.31×10^{-5} $cm^2 s^{-1}$ for H^3.

The Cl^{36} and H^3 concentration profiles obtained from the diffusion experiments are tabulated and shown graphically in Appendix B. An example of Cl^{36} concentration profile for the 100% bentonite sample at low density is shown in Figure 12. Some scatter in experimental data points for Cl^{36} was evident in most of the diffusion cells, particularly in the tagged half-cell. The tritium diffusion profiles for all of the diffusion cells exhibited a great deal of scatter which proved extremely problematic in the estimation of both Co and the experimental diffusion coefficient values.

The diffusion coefficient for each non-reactive diffusion cell was determined by superimposing several "analytical diffusion profiles" onto the experimental data. Each analytical profile was obtained from Equation (12), using a different diffusion coefficient. The coefficient giving the best "eye-fit" of the experimental data was taken as the "experimental" diffusion coefficient. This procedure is illustrated in Figure 12 for chloride in the 100% bentonite/low density soil. In this case, four concentration profiles were generated from Equation (12) using $10^5 D = 0.5, 1, 5$ and 10 $cm^2 s^{-1}$. The data seemed to be best represented by a profile obtained by $D = 1.0 \times 10^{-5} cm^2\ s^{-1}$ and it was therefore chosen. It is apparent from this example, that when estimating the diffusion coefficients, more weight was placed on the data at positive values of x, where the scatter was usually less, than on the tagged half-cell side of the interface.

The values of the experimental diffusion coefficients for chloride and tritium, and the corresponding tortuosity factors obtained from each of the diffusion cells, are listed in Table VII. Included in Table VII are the respective bulk density and water content conditions in each of the diffusion cells. Difficulties were encountered in the sectioning of the low clay content soils, particularly the 0% and 10% samples, which resulted in loss of some soil material and inaccurate partitioning of the sections. As a result, no useable tritium profiles were obtained for the silica sand diffusion cells and the experimental chloride diffusion coefficients obtained exhibited significant differences between replicate samples for the 0% bentonite and, to a lesser degree, the 10%-high density diffusion cells. Of the 0% soil samples, the second replicate value is believed to be erroneous due to the above mentioned sectioning problems.

In general, however, both the chloride and tritium diffusion coefficients of the replicate samples were in good agreement as indicated in Table VII. Therefore for the purposes of calculating strontium diffusion coefficients, the mean tortuosity value of the replicate results was used.

As seen in Table VII, there is a substantial difference in the tortuosity factors calculated from the chloride and tritium diffusion profiles; τ_{Cl} being 2-4 times greater than τ_H (τ_{Cl} ranging from 0.49 to 0.04 while τ_H varies from 0.22 to 0.01). Referring to the soil paste pH values presented in Table II (a), the Pembina bentonite is acidic, with a pH of 3.4 in a soil:water mixture of 1:2 (Table IIa). In addition, based on cation-exchange-capacity (CEC) calculations, Quigley /4/ suggests that approximately 106 meq. of the 136 meq.100g^{-1} CEC appears to be H^+ or H_3O^+. It is therefore likely that exchange reactions between the diffusing H^3 and adsorbed hydrogen ions would have occurred resulting in measured diffusion coefficients, and in turn tortuosity values, that were lower than those anticipated, based on the Cl^{36} concentration profiles. As a result, the tritium tortuosity factors were not used in the calculation of diffusion coefficients for strontium.

Despite the difference in magnitude of the τ values both the H^3 and Cl^{36} results exhibit similar trends, the most obvious being a dramatic decrease in τ with increasing $\rho b/\emptyset v$ within each soil group. Consider for example the τ_{Cl} results for the 50% bentonite group as shown in Figure 13. As $\rho b/\emptyset v$ increases from approximately 1.6 to 3.3 then to 7.2, the τ values decrease from ~0.38 to 0.23 to 0.04, an order of magnitude decrease. This trend was observed in each of the bentonite samples studied (Figure 13). The decrease in the tortuosity factor with increasing bulk density and decreasing water content is significant in that the use of $\tau = 0.67$, a commonly assumed value, would substantially overestimate the actual value under high bulk density conditions. As seen in Table VII, the use of 0.67 could also result in an overestimation of the mean path length in a silica sand. The τ_{Cl} value obtained for the 0% soil sample was on the order of 0.44. Intuitively this value appears to be rather low, however, due to packing problems in the diffusion cells for low clay content soils, the experimental conditions were such that the 0% bentonite samples were only partially saturated (% saturation = 30-40%, Appendix B), thereby decreasing the tortuosity factor. The results of these experiments therefore indicate the empirical nature of the tortuosity factor and its sensitivity to bulk density and water content relationships.

Figure 13 shows the tortuosity to be strongly dependent upon the clay content and the bulk density-porosity ratio. Certainly one would expect that changes in pore structure would be a significant factor contributing to the variability. Other factors that may have contributed include anion exclusion of the Cl^{36}, hydrogen exchange in the case of H^3, or a change in the free-solution diffusion coefficients of the respective "non-reactive" solutes as the ionic strength of the soil solution varied from soil to soil. There is insufficient data to evaluate the independent effect of each factor. In proceeding to use the measured values of τ to calculate diffusion coefficients for Sr, the high degree of variability in τ and a significant degree of uncertainty in the measured values must be acknowledged.

3.3 EXPERIMENTAL STRONTIUM DIFFUSION COEFFICIENTS

The experimental diffusion profiles for Sr^{85} obtained under 'low', 'medium', and 'high' bulk density conditions are shown in both tabular and graphic form in Appendix C. In general, the strontium diffusion profiles exhibited far less scatter than observed for the chloride and tritium data points (Figure 14). As with the Cl^{36} and H^3 results, any scatter that did occur was usually more pronounced at the higher concentration values (tagged half-cells) and the data points were symmetrical about the point (0,0.5).

The procedure for determining the experimental diffusion coefficient (D_{obs}) was similar to that described previously for the chloride and tritium diffusion profiles. Again, more weight was placed on the data at lower Sr^{85} concentrations ($x>0$) for 'eye-fitting' the simulated curves to the experimental data. The experimental diffusion coefficients obtained from this procedure are given in column 6 of Table VIII. In all cases the replicate samples were in good agreement, as were the results between laboratories (University of Waterloo (UW); Ontario Hydro (OH)). In general, D_{obs} values obtained from the two sources differed on average by only 15% for representative samples under 'low' density conditions and less ($\sim$11%) at the 'medium' density values. These differences are within the accuracy limits of the experimental and 'eye-fitting' procedures. Therefore, for the purpose of the following discussions, the values for D_{obs} referred to are the means values of the OH and UW results.

From Figure 15 it can be seen that the experimental values of the Sr diffusion coefficients were significantly affected by the bulk density conditions (and thus the volumetric water content $\emptyset v$) for all of the clay contents studied. The measured diffusion coefficients decreased as the bulk density increased, as was the case for the chloride and tritium results. This relationship can be seen by comparing Figure 15 with Figure 16 which shows the change in $^{\rho}b/\emptyset v$ with % bentonite for the 'low', 'medium', and 'high' density conditions considered. Although the ordering of the relationships are reversed ('low' $^{\rho}b/\emptyset v$ conditions produced higher experimental diffusion coefficients), the general trends of both sets of data are similar, ie, there is a 'leveling-out' effect occurring when the clay content exceeds 10-25%. This trend is represented by the steepening and clustering of the $^{\rho}b/\emptyset v$ versus D_{obs} relationship as the clay content increases as illustrated in Figure 17. The significance of this trend is that increasing the clay content of the buffer materials beyond 10-25% does not result in a noticeable decrease in the diffusion coefficient (Figure 15).

Similar findings were observed by Gillham et al./3/ when, in studying the effect of clay content on strontium diffusion coefficients in Na-bentonite-sand mixtures, it was noted that in the 5% to 100% bentonite range, the bulk density:porosity ratio ($^{\rho}b/\emptyset v$) affected the magnitude of the retardation factor (R) to about the same degree as the Kd. That is, an increase of an order of magnitude in Kd was completely counterbalanced by the decrease in $^{\rho}b/\emptyset v$.

Figure 18 illustrates this counterbalancing for the 'low' density experimental conditions where the maximum retardation factor is attained at an approximate clay content of 10%. This is extremely significant in that further addition of clay beyond 10-25% to a compacted bentonite-sand buffer material will substantially increase disposal costs while providing no added retardation capability.

In addition, from Figure 17, it can be seen that as the clay content rises, the resulting Sr diffusion coefficient becomes increasingly more sensitive to small changes in the bulk density-water content relationship. For example, a change of 1.5 units in $^{\rho}$b/Øv from 3.5 to 2 for the 100% bentonite sample resulted in an increase in the observed diffusion coefficient from 0.5×10^{-7} to 3×10^{-7} cm^2s^{-1}, a 6 fold increase. To obtain the same 6 fold increase in a 10% clay sample, $^{\rho}$b/Øv can vary by more than 14 units. This has practical significance in that, while providing a similar retardation capacity, lower clay content buffer materials can better tolerate the inevitable fluctuations in $^{\rho}$b/Øv produced by variations in vault conditions and buffer placement methods over the expected life of the disposal repository, without sacrificing its integrity with respect to radionuclide retardation.

3.4 CALCULATED STRONTIUM DIFFUSION COEFFICIENTS

The calculated diffusion coefficients for strontium were obtained from Equation (5) using the mean Kd value for a given bentonite-sand mixture and the average tortuosity factor as determined by the Cl^{36} tracer experiments for each of the density categories. The bulk density and water contents were the average of those measured in the respective strontium diffusion cells (Appendix C), and the value used for the free solution diffusion coefficient for strontium was 7.94×10^{-6} cm^2s^{-1} (Li and Gregory /6/). The tortuosity factors, retardation factors, and the resulting calculated strontium diffusion coefficients are given in columns 3, 4 and 5 of Table VIII. At this point, it should be kept in mind that due to the calculating procedures, inaccuracies in tortuosity factors (the chloride experimental diffusion coefficients) and strontium Kd values are inherent in D_{calc}. For example, from Table VIII it can be seen that when comparing D_{calc} values obtained by Ontario Hydro and the University of Waterloo, the agreement is not as good as was observed in the experimental diffusion coefficients (D_{obs}). This difference, however, is directly related to the variation in Sr Kd values obtained by the two laboratories, as reflected by the retardation factors in column 4.

In general, the calculated diffusion coefficients exhibit similar trends to those observed for the experimental diffusion coefficients. That is, D_{calc} decreases with increasing bulk density within each clay content group but does not change appreciably in buffer mixes with clay contents in excess of 25%.

A comparison of the calculated diffusion coefficients for strontium versus the actual experimental results is given in the last column of Table VIII as the ratio D_{calc} to D_{obs}. This relationship is also shown graphically in Figure 19. Generally, under 'low' bulk density conditions, Equation (5) predicted the magnitude of the experimental diffusion coefficients quite well, with the worst case being out by a factor of two (0% for OH and 75% for UW). Ontario Hydro calculations slightly underestimated the actual values while the University of Waterloo results gave an overestimation. As the bulk densities within each % bentonite mixture was increased, the ratio between D_{obs} and D_{cal} increased, indicating a divergence or a worsening of the predictive applicability of Equation (5), with D_{obs}:D_{calc} increasing to a maximum of 6.8 and 9.4

for Ontario Hydro and University of Waterloo calculations respectively. Incorporated into the diffusion coefficients obtained from Equation (5) are any errors associated with the parameters. As noted in previous discussions, there may be significant uncertainty in both the Kd and τ values used to calculate the diffusion coefficient for the intermediate and high bulk density diffusion cells.

In spite of the observed differences between the calculated and experimental diffusion coefficients at the 'medium' and 'high' density conditions, we feel that, for practical purposes, Equation (5) can be used to provide a simple means of estimating diffusion coefficients for Sr^{85} in sand-bentonite mixtures. It is also quite possible that the discrepancies between calculated and measured diffusion coefficients could be decreased if not eliminated if Sr Kd values were determined under solid-to-solution ratios representative of the actual experimental conditions.

4. SUMMARY AND CONCLUSIONS

1. The strontium adsorption isotherms determined for the 0%, 10%, 25%, 50%, 75% and 100% Pembina bentonite-silica sand mixtures were linear over the entire concentration range studied (10^{-4} to 10^{-10} M). This suggests that the 'Kd approach' is an acceptable means of describing the reaction term in the advection-dispersion transport equation for strontium-90 in Pembina bentonite buffer materials.
2. The trend in Kd values was as anticipated, with increasing clay content being strongly correlated with increasing Sr Kd ($r = 0.98$). The magnitude of the Kd values however were not as large as one may have expected for a clay having a cation-exchange-capacity of 136 meq.100g^{-1}. The most probable cause of the low Kd values is the acidic nature of the bentonite (soil paste pH = 3.4), resulting in strong H^+ competition of adsorption sites.
3. The effect of decreasing solution-to-solid ratios on measured Sr Kd values was determined for the 50% bentonite sample. Regression analysis showed that water content (θg) is highly correlated to Sr Kd ($r = 0.9938$) as θg varies from 0.67 to 5.0. The results of this experiment emphasize the necessity of duplicating actual or anticipated field conditions in laboratory measurements of Kd.
4. Chloride-36 and tritium diffusion experiments were conducted to determine tortuosity factors (τ) for the bentonite sand mixtures under vary-

ing bulk density conditions. The results of these experiments indicate a substantial difference in the tortuosity factors calculated using the Cl^{36} and H^3 diffusion profiles. The tortuosity factors for Cl^{36} were 2 to 4 times greater than those for H^3. This is believed to be due to exchange reactions between the diffusing H^3 and adsorbed hydrogen ions, which constitute about 75% of the total exchangeable cations (Quigley /4/). As a result, only the Cl^{36} tortuosity values were used in the calculations of Sr diffusion coefficients.

5. Tortuosity factors for both H^3 and Cl^{36} decreased by an order of magnitude with increasing bulk density-to-water content ratios. For example, Cl^{36} tortuosity factors decreased from 0.38 under the 'low' density conditions to 0.05 under 'high' density conditions for the 50% bentonite sample. Similar trends were observed for all samples studied. This is significant in that the use of τ=0.67, a commonly assumed value, substantially overestimates the actual value for clayey soils under high bulk density conditions and in turn would overestimate the effective diffusion coefficient. The results of these experiments indicate the empirical nature of the tortuosity factor and its sensitivity to bulk density and water content relationships in repacked, fine-grained materials.

6. Experimental strontium diffusion coefficients were determined for the six Pembina bentonite-sand mixtures under varying bulk density conditions. In general, the experimental diffusion coefficients were significantly affected by the bulk density-water content conditions with values decreasing from an average 6×10^{-7} cm^2s^{-1} under 'low' bulk density conditions to 5×10^{-8} cm^2s^{-1} under 'high' bulk density conditions. In

addition, there was a 'leveling-out' effect that occurred under all bulk density conditions in which an increase in clay content of the buffer material in excess of 10% to 25% did not result in a noticeable decrease in the diffusion coefficient. This is significant in that further addition of clay beyond 10-25% to a compacted bentonite-sand material will provide no added retardation capability but could substantially increase disposal costs.

7. Strontium diffusion coefficients were found to become increasingly sensitive to small changes in the bulk density-water content ratio as the clay content was increased. This has practical significance in that, while providing a similar retardation capacity, the variation in expected diffusion coefficients of lower clay content materials will be much smaller than for a higher clay content buffer under a change of similar magnitude in the bulk density-water content ratio.

   Thus a low clay content buffer material, in addition to being more cost effective, would also be more "tolerant" of the inevitable fluctuations in bulk density and water content that could occur as a result of variations in disposal vault conditions and placement techniques over the life of the repository.

8. Strontium diffusion coefficients were calculated using the retardation factor, average Cl^{36} tortuosity factors and a free solution diffusion coefficient of 7.94×10^{-6} cm^2s^{-1}. In general, the calculated diffusion coefficients exhibited similar trends to those observed for the experimental diffusion coefficients, described above. This therefore suggests that calculated diffusion coefficients can be used to establish relationships and trends between physical soil properties and strontium dif-

fusion rates, while being much less time consuming, and therefore more cost efficient than if actual experimental diffusion coefficients were required. It appears however, that great care must be taken in obtaining both the distribution coefficient and the tortuosity values required by the calculation procedure.

9. A comparison of calculated versus experimental strontium diffusion coefficients showed fairly good agreement under the "low" bulk density conditions. As the bulk densities were increased however, the fit between calculated and measured diffusion coefficient values became worse. This is believed to be due to inaccuracies incorporated into the calculated values by the use of Sr Kd values obtained at solution-to-solid ratios representative of the 'low' bulk density conditions. We therefore feel that, despite of the uncertainties in the validity of using the 'low' density Sr Kd values in the calculation procedure, for practical purposes, calculated diffusion coefficients can be used to provide a relatively simple means of estimating diffusion coefficients for radioactive strontium.

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Table I. Pembina Bentonite - Quantitative Mineralogy /4/

	Percentage
Montmorillonite (high charge variety)	∿ 80
Illite (interlayer with montmorillonite)	∿ 10
Quartz	∿ 6
Gypsum	∿ 3
Carbonate	∿ 1
Organics	∿ 0.5

Table IIa. Pembina Bentonite - Physical and Chemical Characteristics /4/

Property	
Specific Surface ($m^2.g^{-1}$)	744
Soil Paste pH (H_2O)	3.4
(.01M $CaCl_2$)	2.5
Saturation water content (% by weight)	125
Pore water chemistry ($meq.L^{-1}$)[1]	
Ca	21.82
Ma	26.75
Na	80.0
K	1.28
CEC ($meq.100g^{-1}$)[2]	∿ 136
Adsorbed cations ($meq.100g^{-1}$)	
Ca	27.2
Mg	15.6
Na	12.1
K	1.2
Sodium adsorption ratio (SAR)	16
Exchange sodium percent (ESP)	22

1. Obtained from water extract of soil wetted to saturation water content
2. Carbonate-free sample

Table IIb. Pembina Bentonite - Physical and Chemical Characteristics

Pore water chemistry (solution:solid ratio - 1.67)

Ion	Concentration ($mg \cdot L^{-1}$)
Ca	485
Mg	213
Na	1230
K	20
Sr	2.2
Cl	240

Table III. Densities (particle and bulk), moisture contents, and batch method solution:solid ratios

Sample (% bentonite)	Density ($g.cm^{-3}$) dry bulk	Density ($g.cm^{-3}$) particle*	Average Moisture Content (wt %)	Ratio $g.H_2O/g.dry$ soil
100	0.5	2.77	17.4	1.66
75	0.75	2.74	12.9	0.97
50	0.9	2.72	5.6	0.75
25	1.4	2.69	3.1	0.35
10	1.75	2.67	1.8	0.20
0	-	2.65	-	0.15

* 0% and 100% are measured values, others are calculated

Table IV. Diffusion experiments - mean density and solution:solid ratios

Mix (% bentonite)	Density Category					
	Low		Medium		High	
	Solution:Solid[1] Ratio	Dry Density[2]	Solution:Solid Ratio	Dry Density	Solution:Solid Ratio	Dry Density
100	1.514	0.53	0.56	1.055	0.315	1.425
75	0.895	0.8	0.45	1.200	0.220	1.665
50	0.709	0.93	0.32	1.400	0.150	1.93
25	0.415	1.28	0.31	1.475	0.100	2.12
10	0.200	1.76	0.15	1.900	0.080	2.20
0	0.103	2.11	N.D[3]	-	N.D	—

1. g H_2O.g dry soil^{-1}
2. g.cm^{-3}
3. not done

Table V. Strontium distribution coefficients

% Pembina Bentonite	Sr Kd $(mL.g^{-1})$* OH	Sr Kd $(mL.g^{-1})$* UW
0	0.06 ± 0.03	0.31 ± 0.06
10	0.58 ± 0.03	1.30 ± 0.11
25	0.97 ± 0.06	2.2 ± 0.10
50	2.37 ± 0.06	4.03 ± 0.07
75	3.87 ± 0.24	5.52 ± 0.20
100	4.69 ± 0.15	9.15 ± 0.41

* mean value ±1 standard deviation

Table VI. Sr Kd as a function of gravimetric water content - 50% Pembina bentonite

Gravimetric water content ($g.g^{-1}$)	Replicate	Sr Concentration Solution Phase ($M \times 10^{-10}$)	 Solid Phase ($M \times 10^{-13}.g^{-1}$)	Kd (mLg^{-1})
0.79	1	1.52	5.70	3.74
	2	1.51	5.72	3.80
	3	1.26	5.91	4.68
0.93	1	1.51	6.87	4.54
	2	1.64	6.75	4.11
	3	1.82	6.58	3.61
1.08	1	1.60	8.02	5.00
	2	1.62	8.00	4.95
	3	1.75	7.86	4.50
2.57	1	2.80	17.15	6.12
	2	2.76	17.26	6.26
	3	2.99	16.66	5.57
5.05	1	3.46	31.20	9.03
	2	3.45	31.22	9.04
	3	3.38	31.58	9.34

Table VII. Summary of chloride and tritium diffusion coefficients results

Soil	Rep*	ρ_b (g.cm^{-3})	$\rho_b/\emptyset_v$	Dx10^6 (cm^2.s^{-1})		Tortuosity** (τ)	
				Cl^{36}	H^3	Cl	H
0%	L_1	1.780	12.6580	9	-	0.44	-
	L_2	1.791	15.8777	5	-	0.25	-
10%	L_1	1.817	5.8144	7.5	10	0.36	0.11
	L_2	1.773	5.7138	7.5	10	0.36	0.11
	H_1	2.000	19.6078	2.5	4	0.12	0.04
	H_2	1.930	20.0000	1.5	3	0.07	0.03
25%	L_1	1.250	2.7245	10	20	0.49	0.22
	L_2	1.260	2.7778	9	13	0.44	0.14
	H_1	2.129	12.7790	1	2	0.05	0.02
	H_2			0.75	2	0.04	0.02
50%	L_1	0.950	1.5697	7.5	9	0.36	0.10
	L_2	0.945	1.6182	8	10	0.39	0.11
	M_1	1.437	3.2680	4	5	0.20	0.05
	M_2	1.453	3.2681	5	5	0.25	0.05
	H_1	1.920	7.1937	0.75	0.75	0.04	0.01
	H_2	1.959	7.3536	0.75	-	0.04	-
75%	L_1	0.791	1.1792	8	9	0.39	0.10
	L_2	0.810	1.2611	5	6	0.25	0.06
	H_1	1.580	3.8462	1	2	0.05	0.02
	H_2	1.662	?	1	2	0.05	0.02
100%	L_1	0.548	0.7412	10	13	0.49	0.14
	L_2	0.542	0.7013	10	10	0.49	0.11
	H_1	1.345	3.4719	0.75	2	0.04	0.02
	H_2	1.439	3.4725	1	2	0.05	0.02

* L_1 = low density - replicate 1
M = medium density
H = high density

** calculated using equation with
$D_o^{Cl} = 2.03 \times 10^{-5}$ cm^2.s^{-1}
$D_o^{H} = 9.31 \times 10^{-5}$ cm^2.s^{-1}

Table VIII. Summary of strontium diffusion coefficient results

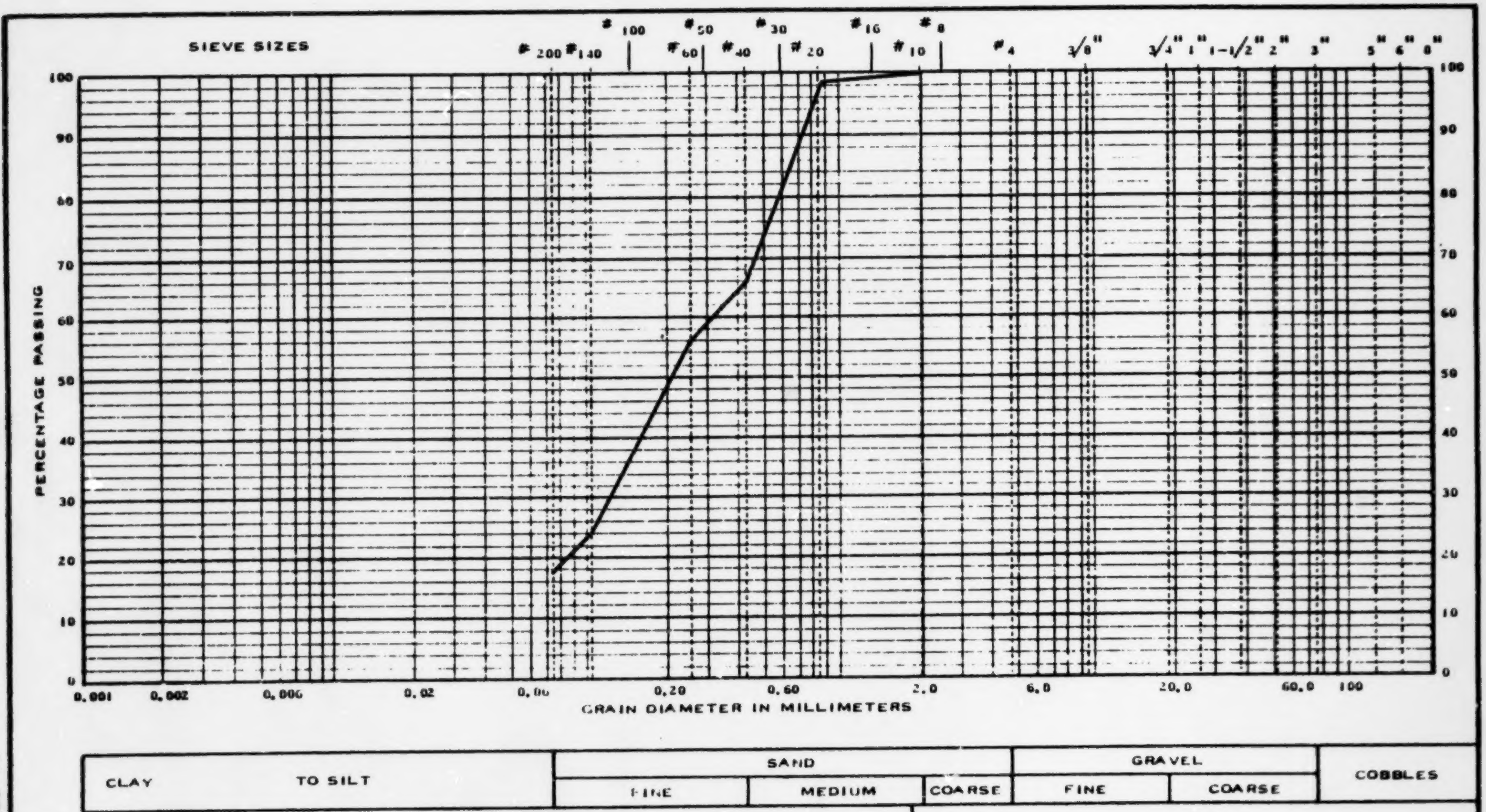
Soil	Rep	τ^*	R		$D_{calc}^{**} \times 10^7 (cm^2.s^{-1})$		$D_{obs} \times 10^7 (cm^2.s^{-1})$		D_{obs}/D_{calc}	
			OH	UW	OH	UW	OH	UW	OH	UW
0%	L_1	0.44	1.66	4.34	21.04	8.05	10	12.5	0.48	1.56
	L_2		1.75	4.22	19.96	8.28	10	12.5	0.50	1.51
	L_3		1.86	-	18.78	-	10	-	0.53	-
10%	L_1	0.36	4.33	8.07	6.60	3.54	5.5	6	0.83	1.70
	L_2		4.63	7.98	6.20	3.58	5.5	6	0.89	1.70
	M_1	0.23	5.32	10.64	3.43	1.72	5.5	-	1.60	2.90
	M_2		5.33	10.67	3.43	1.71	5	-	1.47	2.90
	H_1	0.09	11.70	24.89	0.61	0.29	-	2	2.87	6.03
	H_2		12.55	26.80	0.57	0.27	-	1.5	2.60	6.03
25%	L_1	0.47	3.68	6.17	10.00	5.98	6	7	0.60	1.20
	L_2		3.57	6.90	10.30	5.35	6	7	0.60	1.30
	M_1	0.23	4.58	9.12	3.99	2.00	5	-	1.25	2.50
	M_2		4.62	9.20	3.95	1.99	5	-	1.25	2.50
	H_1	0.05	13.43	29.20	0.27	0.12	-	0.6	2.20	5.00
	H_2		14.59	31.82	0.25	0.11	-	0.8	3.20	7.30
50%	L_1	0.38	4.60	6.89	6.47	4.32	6	7	0.93	1.60
	L_2		4.58	6.84	6.50	4.38	5.5	7	0.85	1.60
	M_1	0.23	8.83	12.25	2.07	1.49	3.5	3	1.45	2.01
	M_2		8.85	12.61	2.06	1.45	3.5	3	1.45	2.07
	H_1	0.04	20.61	36.11	0.15	0.09	-	0.5	3.30	5.60
	H_2		21.06	34.70	0.15	0.09	-	0.5	3.30	5.60
75%	L_1	0.39	5.64	7.68	5.49	4.03	6	8	1.09	1.99
	L_2		5.88	7.73	5.27	4.01	-	8	-	2.00
	M_1	0.23	9.89	13.58	1.85	1.34	3.5	4	1.90	2.99
	M_2		9.97	13.58	1.83	1.35	3.5	4	1.90	2.96
	H_1	0.04	18.00	25.06	0.22	0.16	-	1.5	6.82	9.40
	H_2		17.07	23.73	0.23	0.17	-	1.5	6.82	8.80

100%	L_1	0.39	4.18	7.13	9.31	5.46	7	8	0.75	1.47
	L_2		4.42	7.13	8.80	5.46	7.5	8	0.85	1.47
	M_1	0.23	9.6	17.83	1.90	1.02	3.5	3	1.84	2.94
	M_2		10.45	17.93	1.75	1.02	3.5	3	2.00	2.94
	H_1	0.05	18.8	35.67	0.17	0.09	-	0.5	2.94	5.55
	H_2		16.8	31.74	0.19	0.10	-	0.5	2.63	5.00

* average chloride values

** calculated using equation with $D_o^{Sr} = 7.94 \times 10^{-6}$ cm^2.s^{-1}

MECHANICAL ANALYSIS



UNIFIED SOIL CLASSIFICATION

FIGURE 1: Grain-size Curve for Silica Sand

CRUSHED SILICA SAND PASSING NO 10 SIEVE

THE HYDRO-ELECTRIC POWER COMMISSION
OF ONTARIO

RESEARCH DIVISION

E–

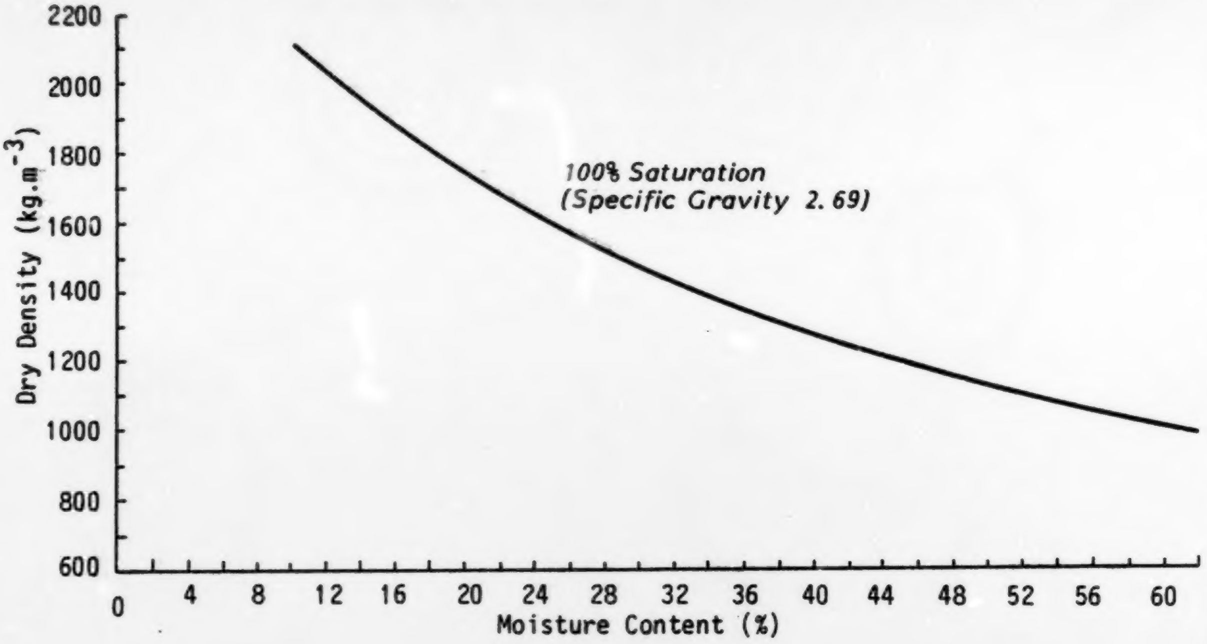


FIGURE 2: Standard Proctor Compaction Curve at 100% Saturation (Specific Gravity 2.69)

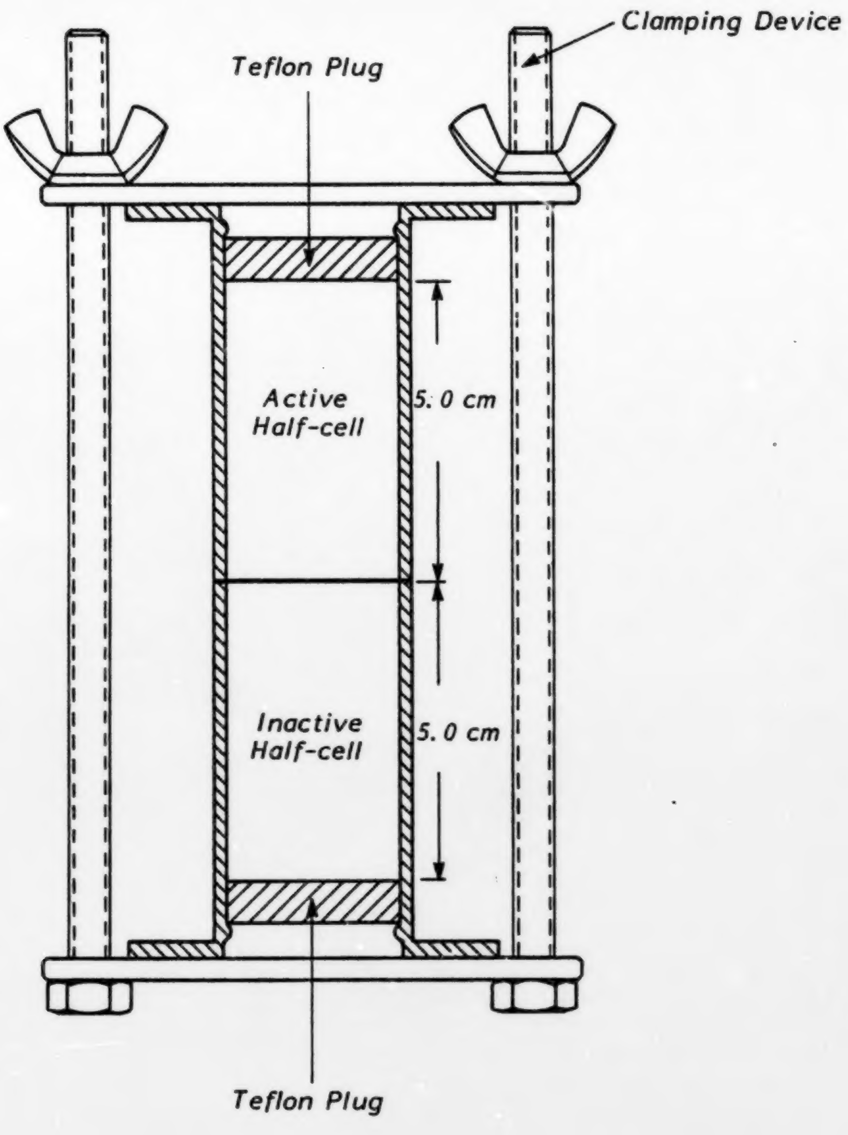

Clamping Device
Teflon Plug
Active Half-cell
5.0 cm
Inactive Half-cell
5.0 cm
Teflon Plug

FIGURE 3: Schematic of Low- and Medium-Density Diffusion Cell

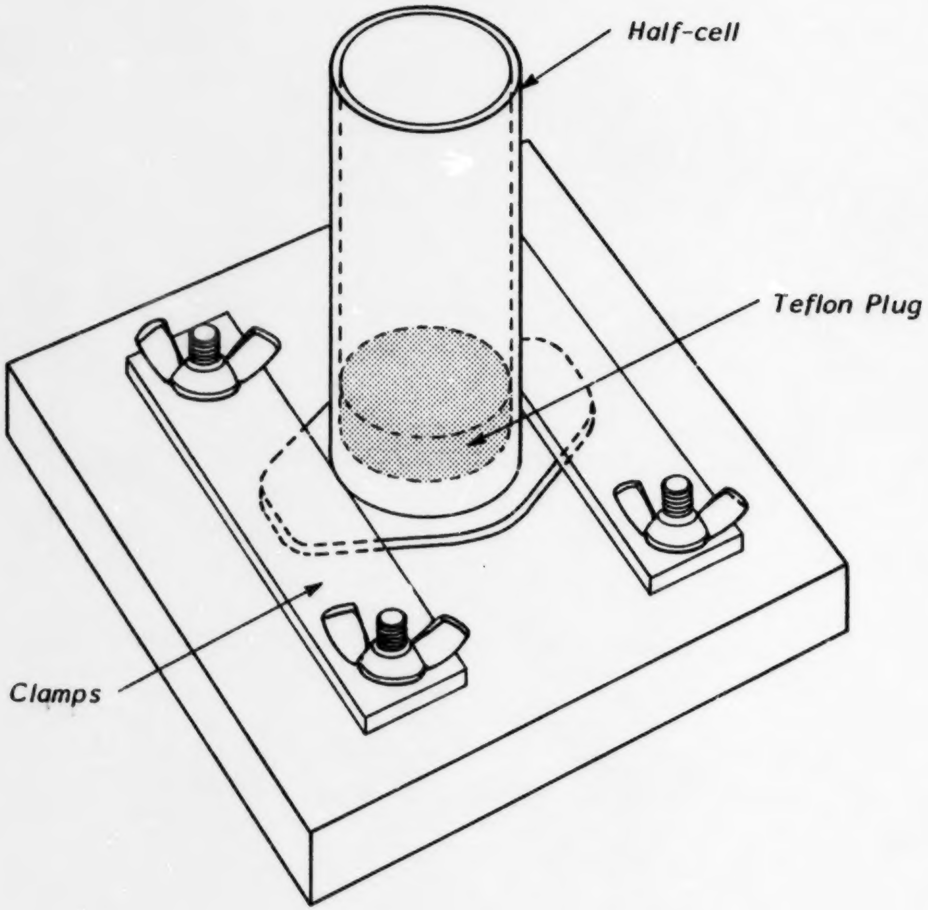

Half-cell
Teflon Plug
Clamps

FIGURE 4: Holding Device for Packing Half-Cells

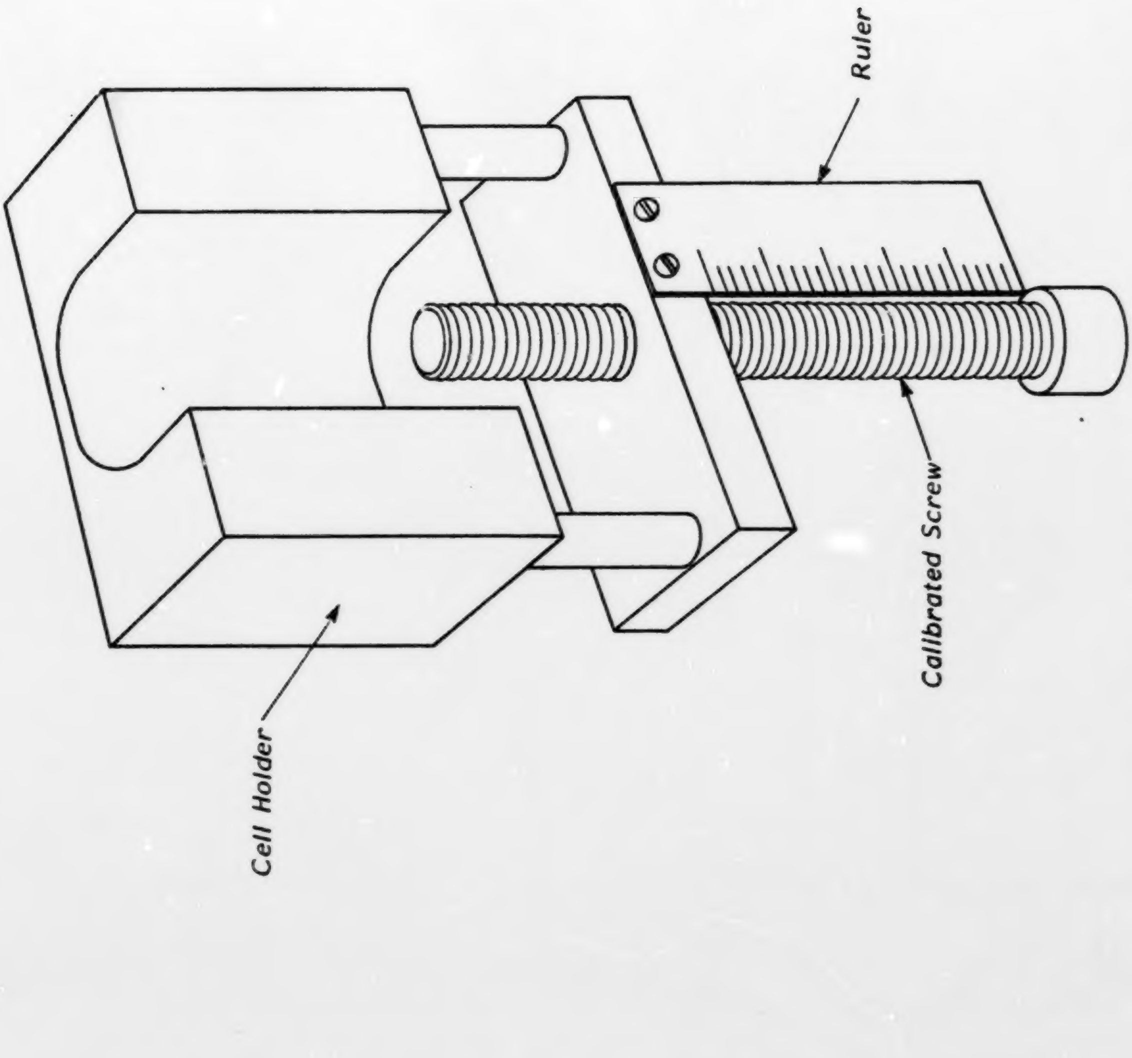

Cell Holder
Calibrated Screw
Ruler

FIGURE 5: Sectioning Apparatus for Low-and Medium-Density Diffusion Cells

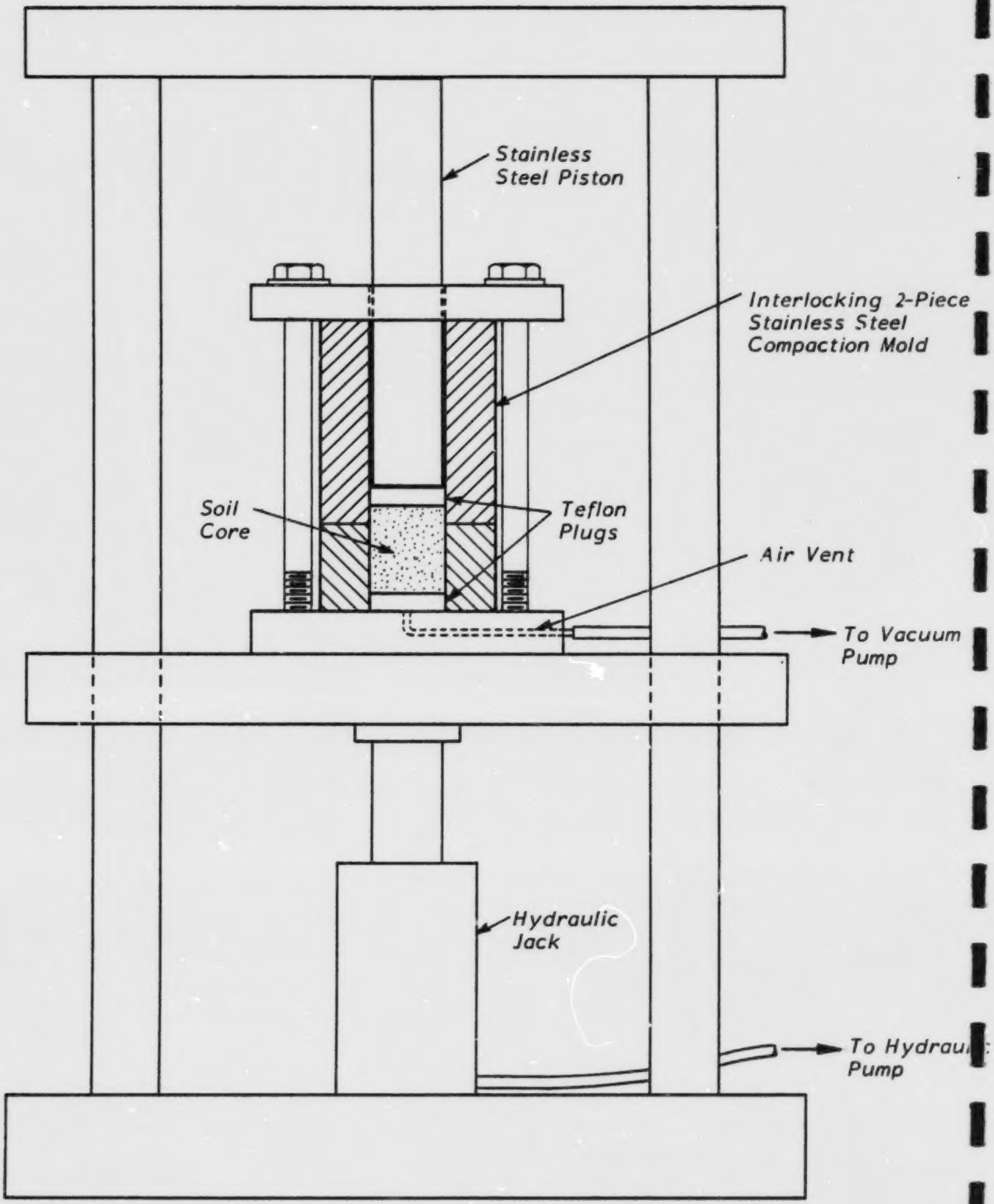

Stainless Steel Piston
Interlocking 2-Piece Stainless Steel Compaction Mold
Soil Core
Teflon Plugs
Air Vent
To Vacuum Pump
Hydraulic Jack
To Hydrau Pump

FIGURE 6: Compaction Mold for High-Density Diffusion Half-Cells

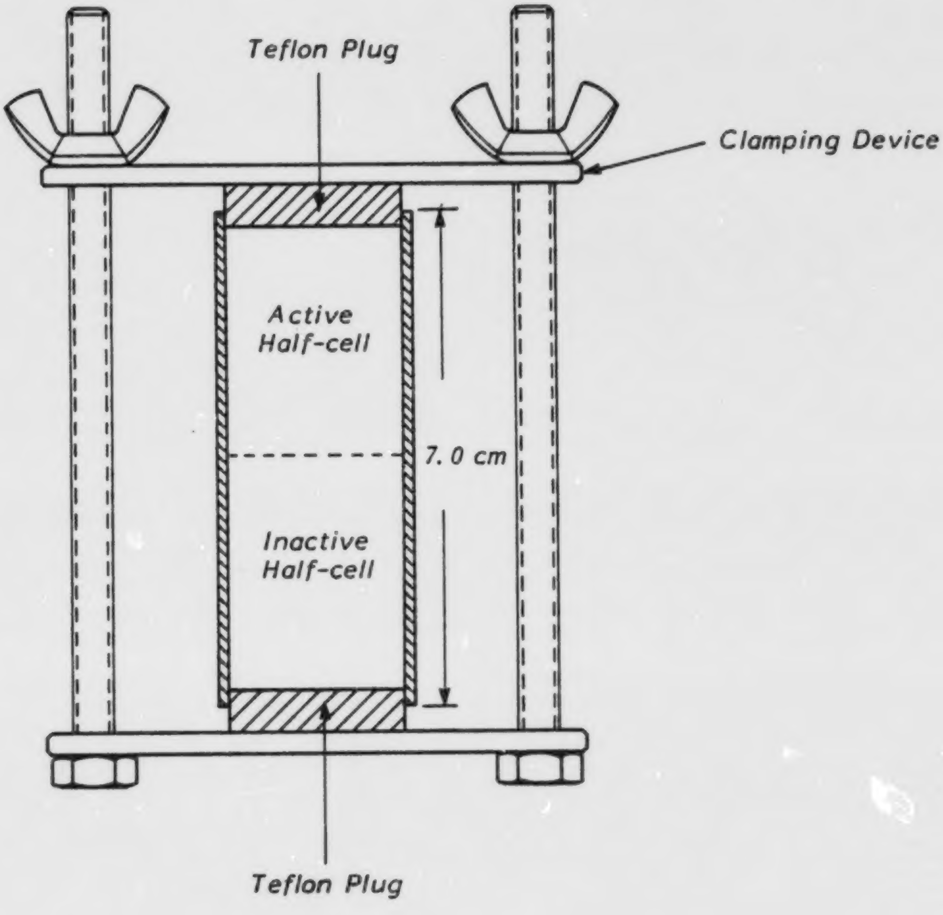

Teflon Plug
Clamping Device
Active Half-cell
7.0 cm
Inactive Half-cell
Teflon Plug

FIGURE 7: Compacted High-Density Diffusion Cell

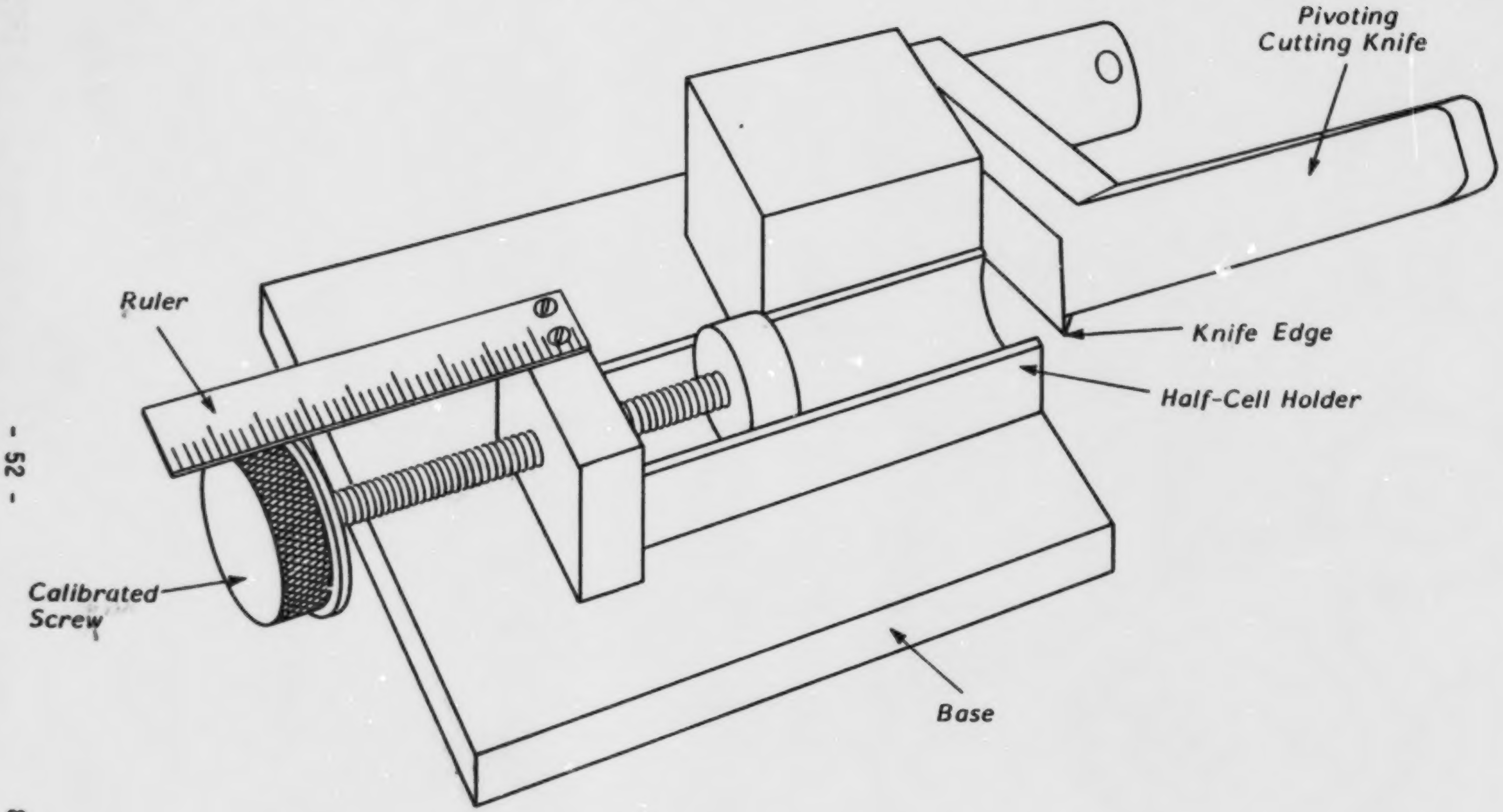

Pivoting
Cutting Knife
Ruler
Knife Edge
Half-Cell Holder
Calibrated
Screw
Base

FIGURE 8: Sectioning Apparatus for High-Density Diffusion Cells

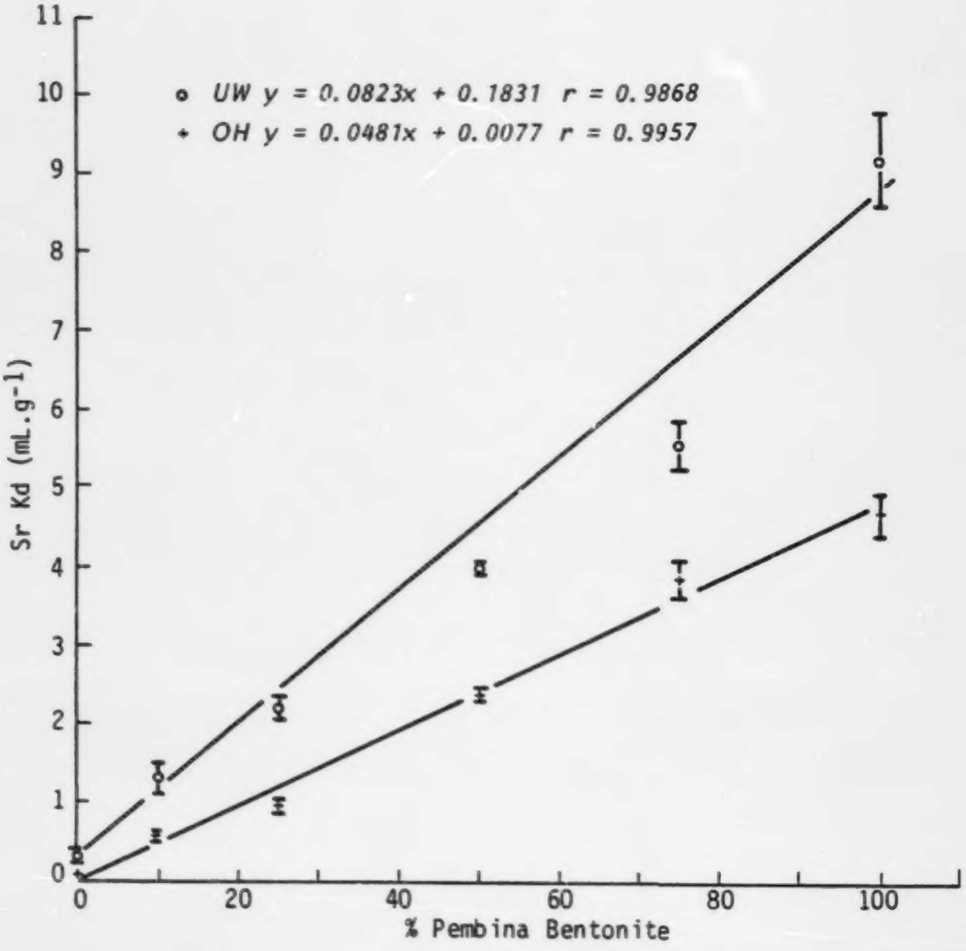


FIGURE 9: Strontium Kd Values Versus % Pembina Bentonite

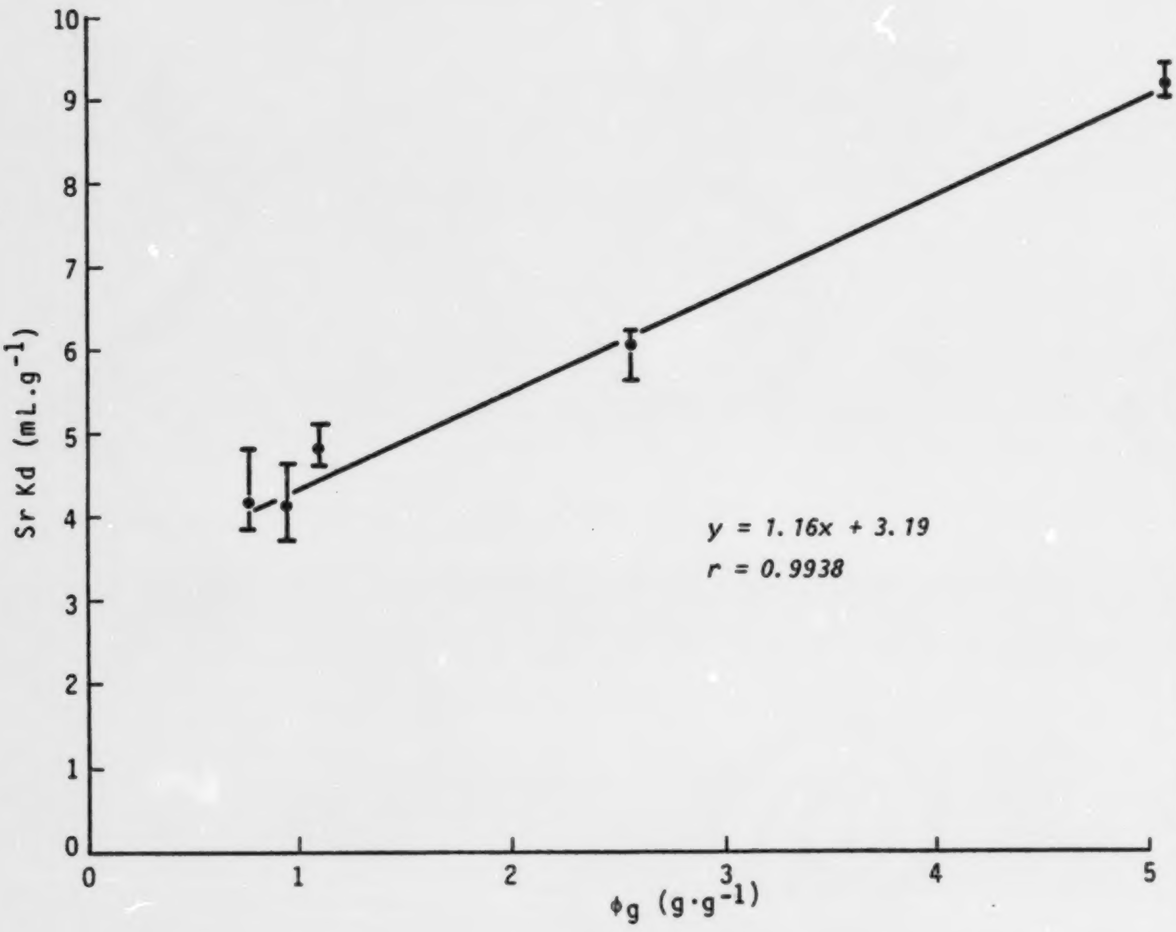


FIGURE 10: Effect of Solution:Solid Ratios on Sr Kd Values for 50% Pembina Bentonite

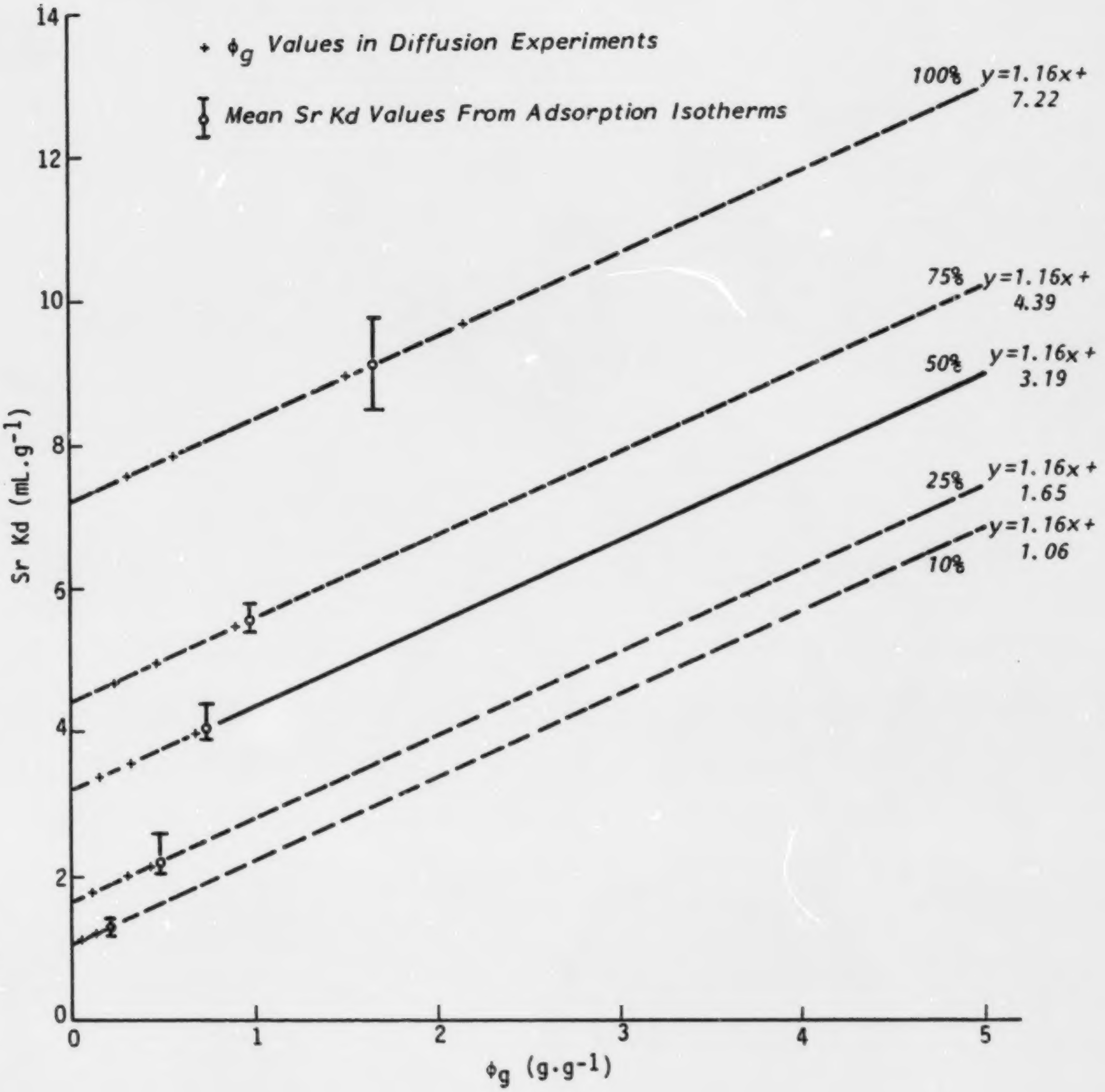


FIGURE 11: Extrapolated Effect of Solution:Solid Ratios on Sr Kd Values for All Bentonite Samples

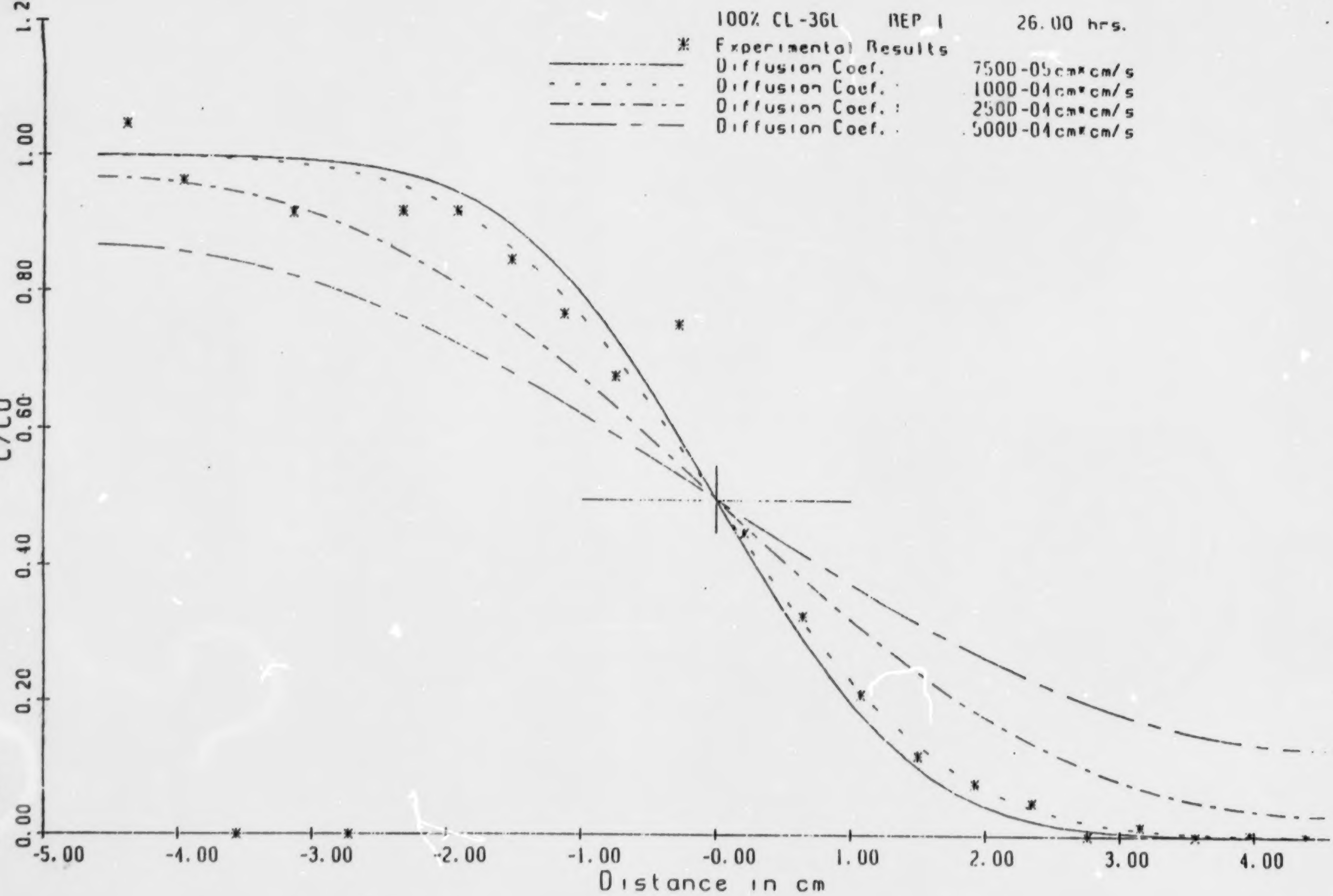


FIGURE 12: Example of Diffusion Data for Cl-36: 100% Pembina Bentonite High Density

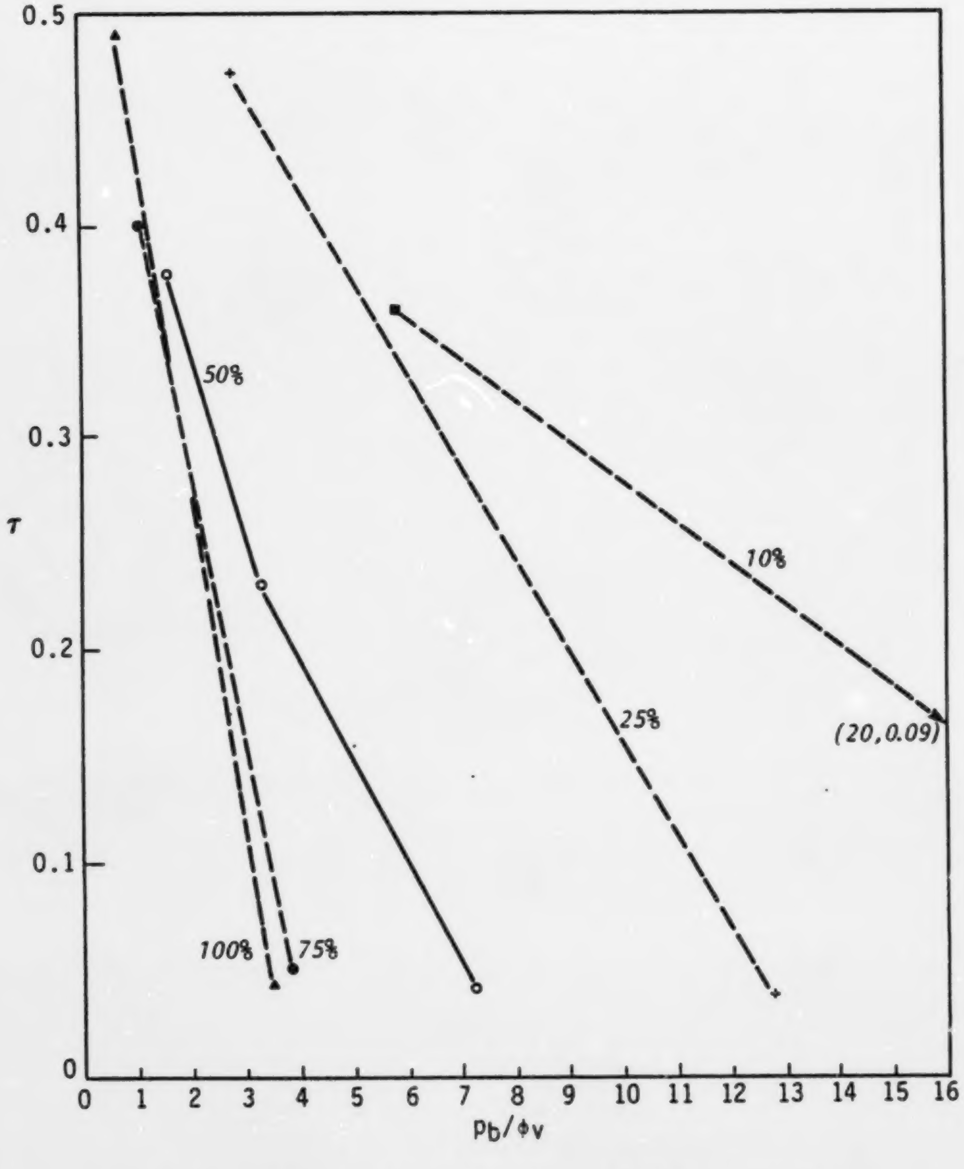


FIGURE 13: Effect of Bulk Density and Water Content on Tortuosity - Cl^{36} Results

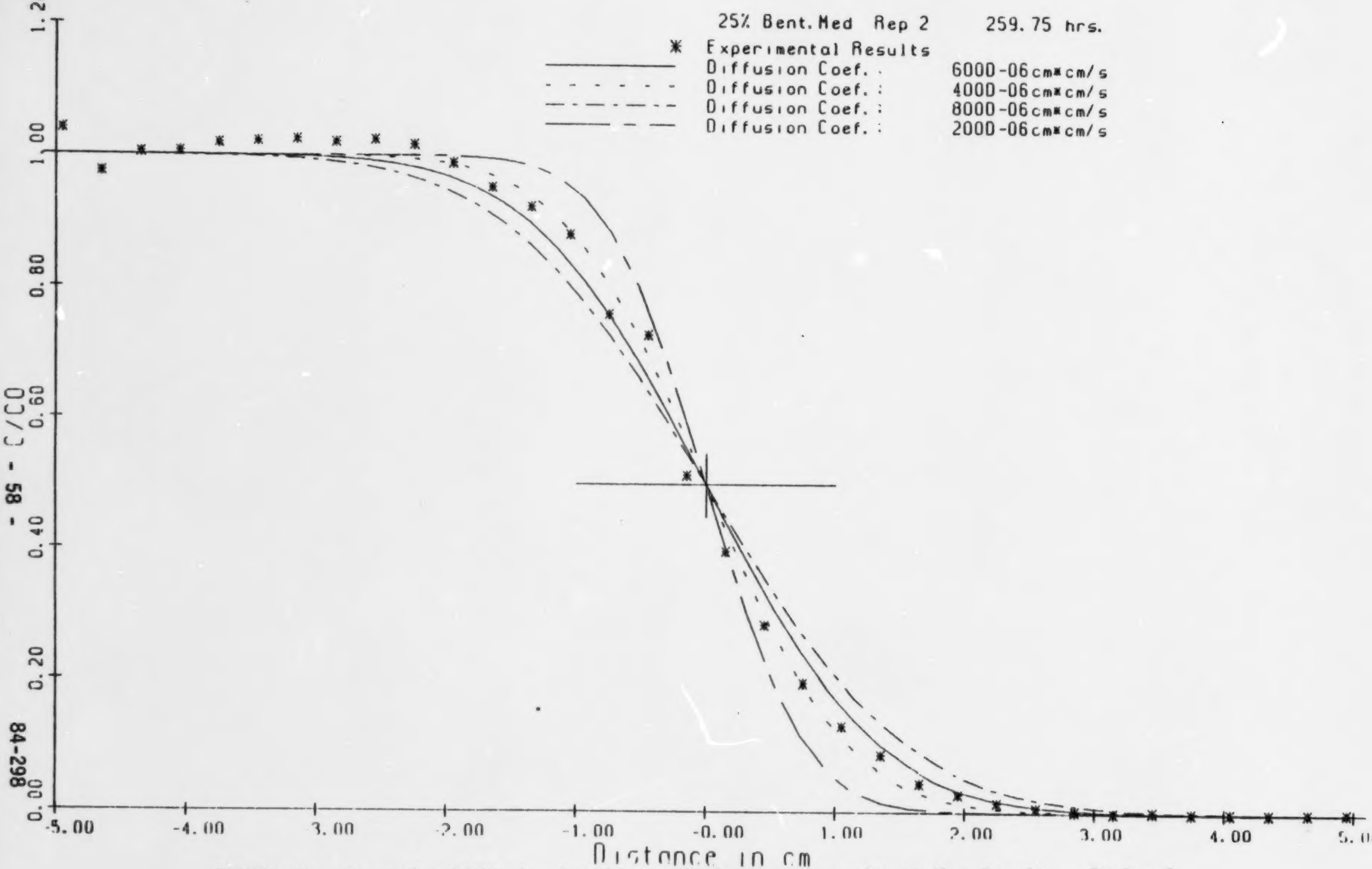


FIGURE 14: Strontium Diffusion Profile: 25% Pembina Bentonite-Medium Density - OH Rep 2

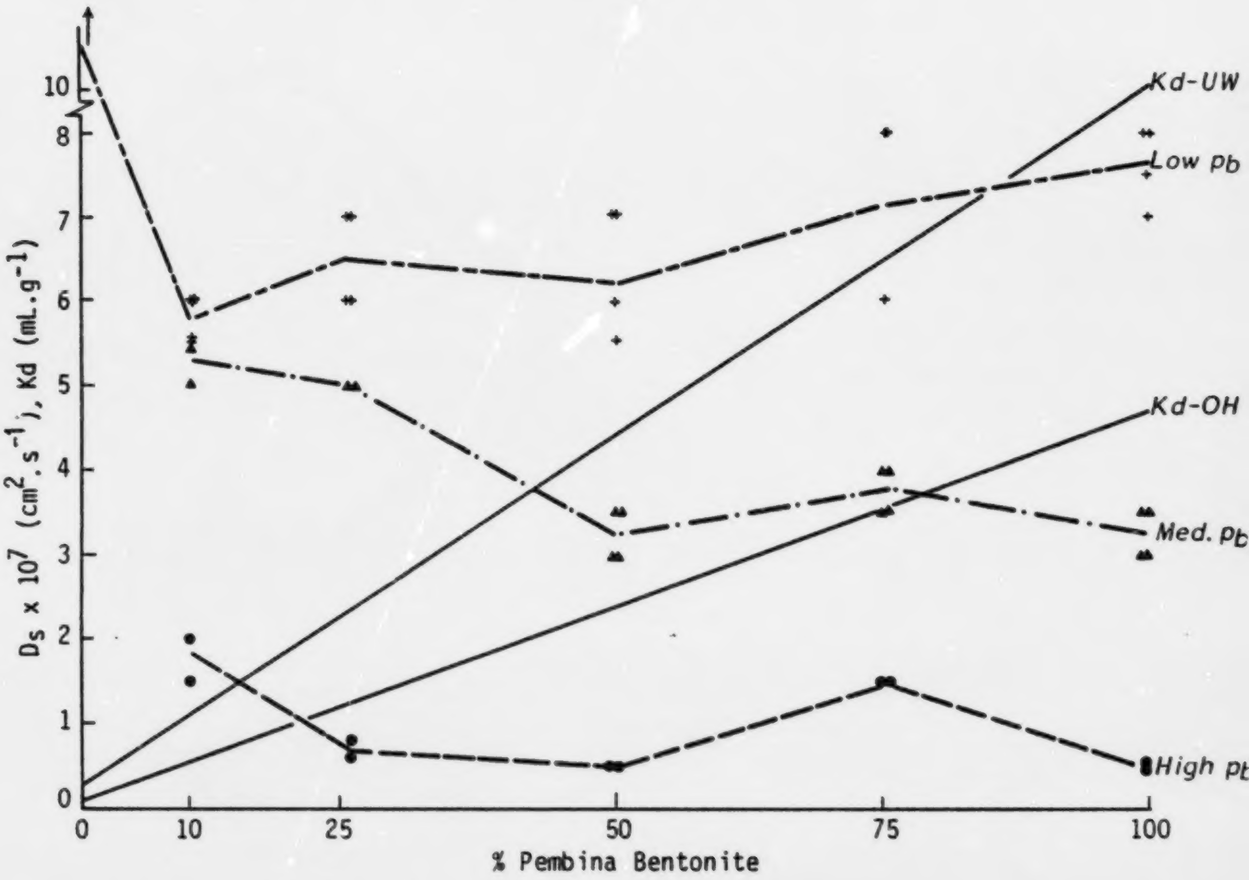


FIGURE 15: Experimental Diffusion Coefficients for Strontium versus % Pembina Bentonite

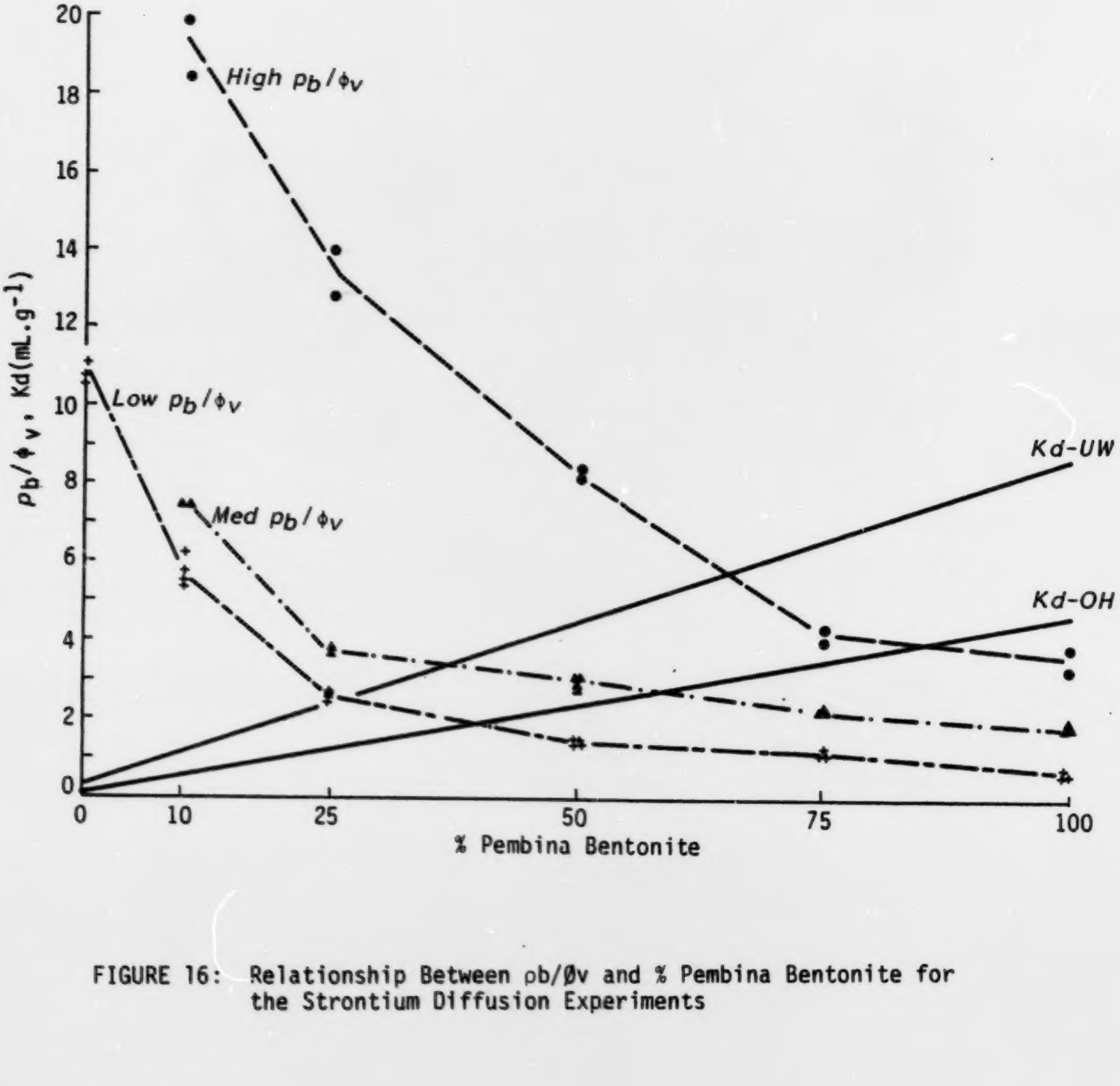


FIGURE 16: Relationship Between $\rho b/\phi v$ and % Pembina Bentonite for the Strontium Diffusion Experiments

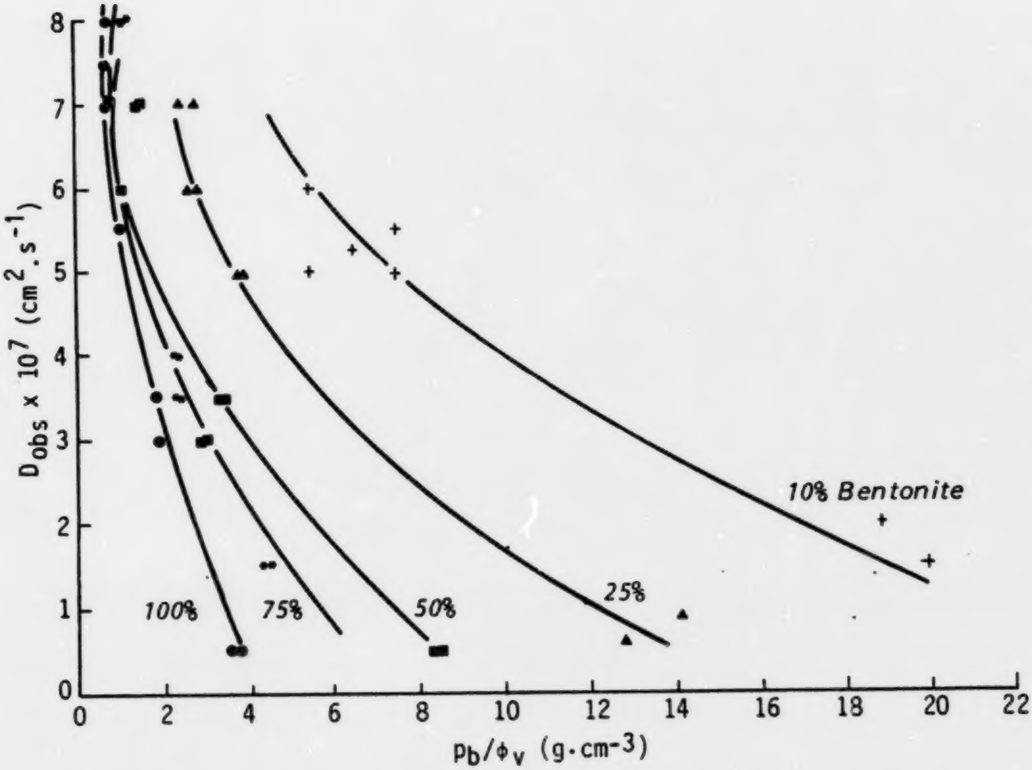


FIGURE 17: Experimental Strontium Diffusion Coefficients versus ρ_b/ϕ_v

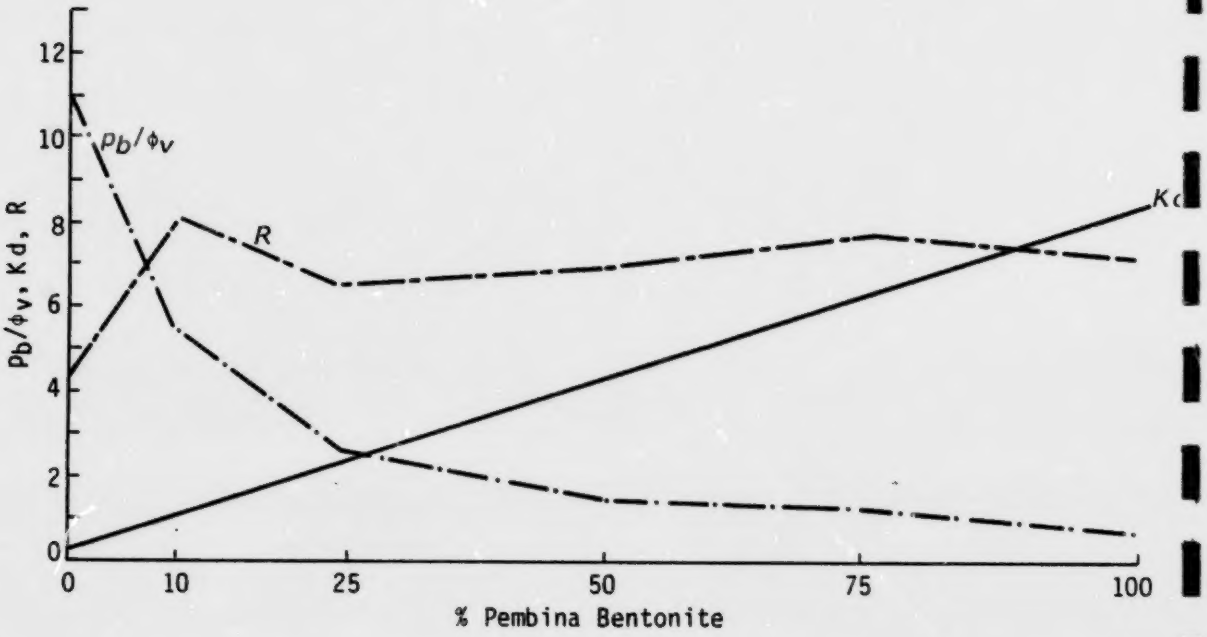


FIGURE 18: Strontium Kd Values, Bulk Density:Water Content Ratios, and Retardation Factors versus % Pembina Bentonite

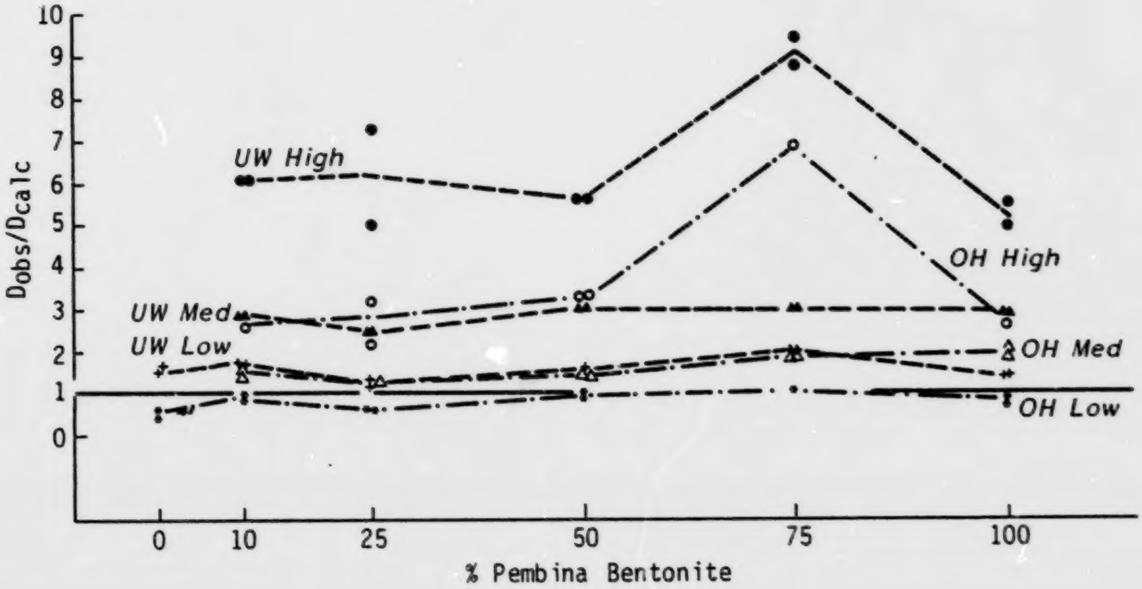
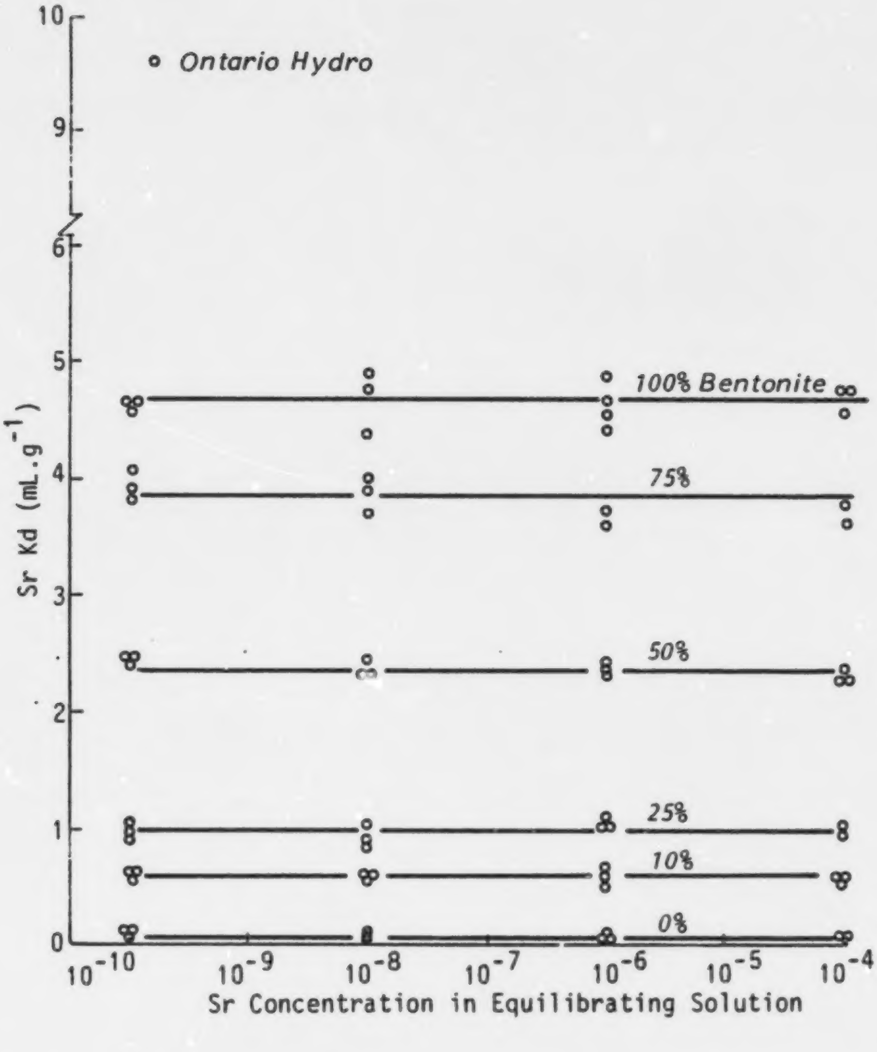


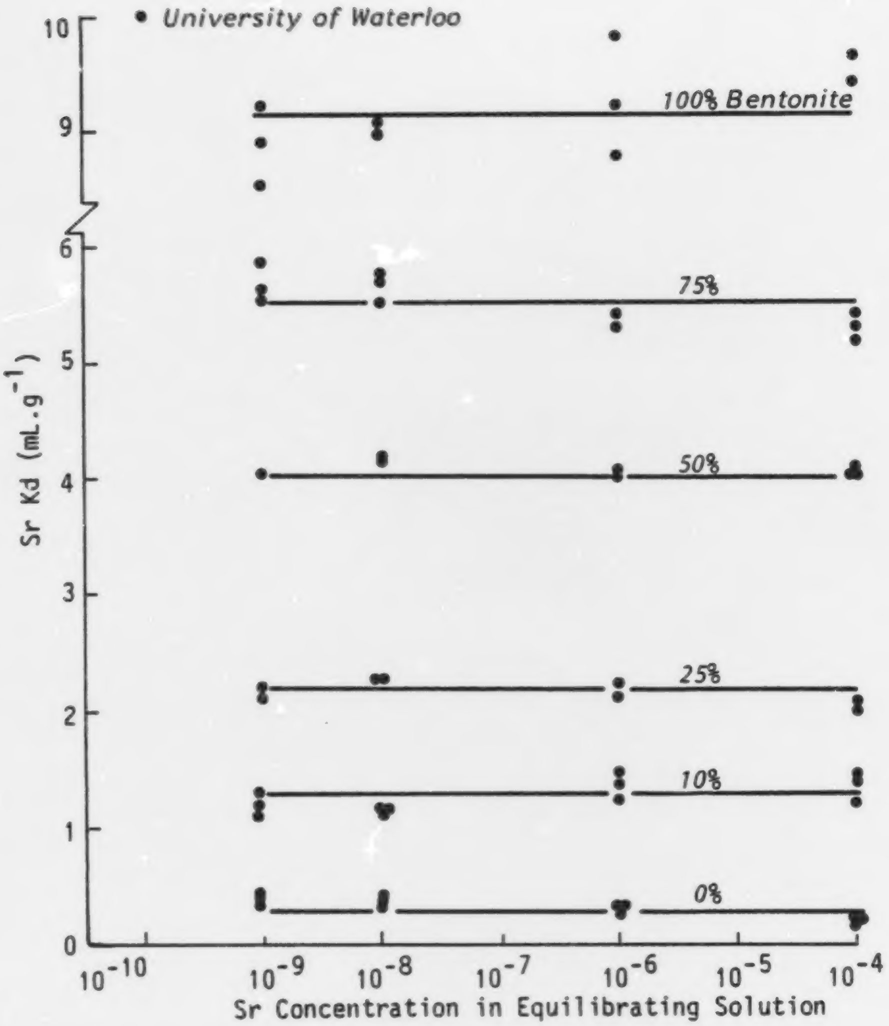
FIGURE 19: Ratio of Experimental to Calculated Strontium Diffusion Coefficients versus % Pembina Bentonite

Appendix A

STRONTIUM DISTRIBUTION CURVES



○ Ontario Hydro
Sr Kd (mL.g⁻¹)
10
9
6
5
4
3
2
1
0
100% Bentonite
75%
50%
25%
10%
0%
10⁻¹⁰
10⁻⁹
10⁻⁸
10⁻⁷
10⁻⁶
10⁻⁵
10⁻⁴
Sr Concentration in Equilibrating Solution


University of Waterloo
100% Bentonite
75%
50%
25%
10%
0%
Sr Kd (mL.g^{-1})
0
1
2
3
4
5
6
9
10
10^{-10}
10^{-9}
10^{-8}
10^{-7}
10^{-6}
10^{-5}
10^{-4}
Sr Concentration in Equilibrating Solution

Appendix B

CHLORIDE AND TRITIUM DIFFUSION DATA

0% Bentonite

L Bulk Density

Distance from interface (cm)	C / CO H-3	C / CO Cl-36
-4.50	0.758015	0.715468
-4.02	1.435634	1.273301
-3.46	1.082716	0.999961
-2.95	1.191695	1.178827
-2.53	0.0	0.0
-2.18	0.836844	0.855033
-1.77	0.661663	0.795411
-1.42	0.522505	0.569254
-1.14	0.439779	0.491187
-0.84	0.509747	0.587162
-0.60	0.249106	0.336716
-0.41	0.366452	0.378752
-0.16	0.528331	0.563785
0.14	0.294173	0.575902
0.37	0.190101	0.302776
0.64	0.294905	0.364329
0.98	0.225049	0.272804
1.31	0.206923	0.222672
1.60	0.167272	0.145034
1.96	0.168291	0.120478
2.29	0.0	0.0
2.64	0.140902	0.089594
3.17	0.0	0.0
3.66	0.064134	0.028739
4.15	0.063050	0.024449

Rep. 1, Time: 174600 s
CO H-3: 1307.4 cpm/mL
CO Cl-36: 932.5 cpm/mL
Average Bulk Density................1.7800 g/cc
Average Gravimetric Water Content...0.0790 g/g

0% Bentonite

L Bulk Density

Distance from interface (cm)	C / CO H-3	C / CO Cl-36
-3.26	0.0	0.0
-2.84	1.065368	1.027749
-2.45	0.0	0.0
-2.07	0.950176	0.929135
-1.69	0.910677	0.962172
-1.31	0.921959	0.899407
-1.01	0.586982	0.610235
-0.76	0.556775	0.603722
-0.51	0.503142	0.577433
-0.29	0.399781	0.424966
-0.10	0.386479	0.580429
0.30	0.244953	0.616358
0.68	0.202180	0.314288
0.94	0.143976	0.202100
1.19	0.169116	0.122584
1.41	0.188410	0.065734
1.73	0.0	0.0
2.08	0.158085	0.020218
2.39	0.141321	0.013105
2.75	0.122406	0.006018
3.12	0.077428	0.001850
3.48	0.072674	0.001615
3.86	0.0	0.0

Rep. 2, Time: 81900 s
CO H-3: 932.9 cpm/mL
CO Cl-36: 1919.1 cpm/mL
Average Bulk Density..................1.7910 g/cc
Average Gravimetric Water Content...0.0630 g/g

10% Bentonite

L Bulk Density

Distance from interface (cm)	C / CO H-3	C / CO Cl-36
-4.10	0.664009	0.760681
-3.69	1.488049	1.383849
-3.18	1.218544	1.185140
-2.78	0.969021	0.910342
-2.40	0.0	0.0
-2.02	0.610911	0.803362
-1.65	0.669053	0.824752
-1.32	0.0	0.0
-0.99	0.676868	0.625062
-0.69	0.622932	0.612620
-0.42	0.614714	0.594366
-0.12	0.387343	0.388929
0.18	0.320950	0.324956
0.50	0.340363	0.323324
0.70	0.246451	0.223593
0.97	0.189087	0.169875
1.22	0.233218	0.206612
1.55	0.213014	0.190774
1.93	0.161363	0.138525
2.32	0.105972	0.083076
2.77	0.066700	0.048951
3.27	0.053722	0.038828
3.76	0.0	0.0
4.25	0.018958	0.012148

Rep. 1, Time: 172800 s
CO H-3: 2349.6 cpm/mL
CO Cl-36: 1531.1 cpm/mL
Average Bulk Density................1.8170 g/cc
Average Gravimetric Water Content...0.1720 g/g

10% Bentonite

L Bulk Density

Distance from interface (cm)	C / CO H-3	C / CO Cl-36
-4.42	0.0	0.0
-4.16	1.046858	0.967528
-3.76	0.952048	1.004892
-3.36	0.0	0.0
-2.96	0.949434	0.957684
-2.56	1.025018	0.982675
-2.15	0.0	0.0
-1.77	0.899449	0.848766
-1.35	0.980789	1.017176
-0.93	0.771017	0.749716
-0.56	0.570325	0.662568
-0.18	0.552170	0.600233
0.23	0.479151	0.496685
0.65	0.264432	0.290865
1.05	0.203403	0.187116
1.46	0.120474	0.105852
1.87	0.066522	0.053698
2.27	0.029133	0.024947
2.62	0.0	0.0
2.99	0.004924	0.003490
3.42	0.0	0.0
3.82	0.001345	0.0
4.18	0.0	0.0
4.47	0.0	0.0

Rep. 2, Time: 81000 s
CO H-3: 2257.4 cpm/mL
CO Cl-36: 2234.7 cpm/mL
Average Bulk Density................1.7730 g/cc
Average Gravimetric Water Content...0.1750 g/g

10% Bentonite

H Bulk Density

Distance from interface (cm)	C / CO H-3	C / CO Cl-36
-3.16	0.0	0.0
-2.75	0.847037	1.097787
-2.32	0.0	0.0
-1.91	0.746721	0.864566
-1.66	0.330558	0.636327
-1.19	1.524576	1.077854
-0.67	0.557218	0.607740
-0.36	0.513278	0.566629
-0.05	0.491027	0.515749
0.23	0.292331	0.370978
0.68	0.431796	0.352947
1.15	0.154303	0.099990
1.47	0.106741	0.049831
1.72	0.055952	0.020457
2.11	0.0	0.0
2.54	0.028445	0.002557
2.85	0.013543	0.000852
3.08	0.0	0.0
3.27	0.009986	0.0

Rep. 1, Time: 167400 s
CO H-3: 482.2 cpm/mL
CO Cl-36: 762.6 cpm/mL
Average Bulk Density................2.0000 g/cc
Average Gravimetric Water Content...0.0510 g/g

10% Bentonite

H Bulk Density

Distance from interface (cm)	C / CO H-3	C / CO Cl-36
-2.38	0.0	0.0
-1.98	0.791122	0.950746
-1.64	0.727955	0.860295
-1.33	0.846963	0.914324
-1.03	0.874129	0.896113
-0.73	0.883138	0.906692
-0.43	0.947225	0.967219
-0.14	0.828185	0.836720
0.10	0.564990	0.668212
0.49	0.173631	0.020251
0.92	0.150061	0.085312
1.20	0.244366	0.062567
1.74	0.0	0.0
2.37	0.004933	0.0

Rep. 2, Time: 165600 s
CO H-3: 414.2 cpm/mL
CO Cl-36: 661.7 cpm/mL
Average Bulk Density................1.9300 g/cc
Average Gravimetric Water Content...0.0500 g/g

25% Bentonite

L Bulk Density

Distance from interface (cm)	C / CO H-3	C / CO Cl-36
-4.61	0.0	0.0
-4.28	1.161398	1.152877
-3.89	0.774073	0.829438
-3.49	0.0	0.0
-3.10	0.927644	0.886339
-2.75	0.955789	0.966330
-2.30	0.0	0.0
-1.83	0.920644	0.941584
-1.43	0.967196	0.923404
-1.01	0.763555	0.814596
-0.58	0.721036	0.671571
-0.19	0.548040	0.508604
0.18	0.443662	0.440497
0.56	0.261485	0.329165
0.96	0.240080	0.246650
1.35	0.174835	0.160526
1.76	0.118551	0.107234
2.19	0.061957	0.051745
2.60	0.0	0.0
3.02	0.014007	0.012048
3.46	0.007845	0.004966
3.88	0.0	0.0
4.34	0.002506	0.000516

Rep. 1, Time: 86400 s
CO H-3: 2937.5 cpm/mL
CO Cl-36: 1842.7 cpm/mL
Average Bulk Density................1.2500 g/cc
Average Gravimetric Water Content...0.3670 g/g

25% Bentonite

L Bulk Density

Distance from interface (cm)	C / CO H-3	C / CO Cl-36
-4.68	0.0	0.0
-4.41	1.226098	1.076459
-3.99	1.229493	1.084697
-3.57	0.0	0.0
-3.14	1.165385	1.012872
-2.74	0.0	0.0
-2.34	0.968730	0.988763
-1.95	0.814116	0.805614
-1.54	0.830463	0.820275
-1.11	0.454683	0.656875
-0.69	0.349087	0.579190
-0.24	0.352602	0.693100
0.20	0.439983	0.450430
0.60	0.353982	0.308469
1.02	0.255138	0.220710
1.44	0.156588	0.131325
1.82	0.065032	0.073368
2.23	0.060087	0.047133
2.62	0.0	0.0
3.01	0.017248	0.012117
3.43	0.006614	0.005527
3.84	0.0	0.0
4.27	0.000864	0.001022
4.53	0.0	0.0

Rep. 2, Time: 96300 s
CO H-3: 3204.7 cpm/mL
CO Cl-36: 2397.5 cpm/mL
Average Bulk Density ....1.2600 g/cc
Average Gravimetric Water Content...0.3600 g/g

25% Bentonite

H Bulk Density

Distance from interface (cm)	C / CO H-3	C / CO Cl-36
-2.71	0.0	0.0
-2.21	1.054127	1.072658
-1.81	0.0	0.0
-1.47	1.023579	1.082972
-1.18	0.979754	1.014071
-0.88	0.885471	0.962849
-0.58	0.782053	0.774864
-0.30	0.643257	0.639877
-0.01	0.457191	0.486776
0.29	0.425863	0.347759
0.60	0.219553	0.165148
0.90	0.148925	0.074145
1.20	0.080678	0.026694
1.48	0.034751	0.007887
1.77	0.012572	0.001863
2.06	0.0	0.0
2.35	0.0	0.000433
2.69	0.0	0.0
3.03	0.003255	0.001213

```
Rep. 1,  Time:   165600 s
CO H-3:     551.8 cpm/mL
CO Cl-36:    1153.8 cpm/mL
Average Bulk Density................2.1290 g/cc
Average Gravimetric Water Content...0.0750 g/g
```

25% Bentonite

H Bulk Density

Distance from interface (cm)	C / CO H-3	C / CO Cl-36
-3.22	0.0	0.0
-2.81	0.926296	1.013060
-2.54	0.974583	1.059959
-2.24	0.0	0.0
-1.96	0.853540	0.872175
-1.67	0.926677	1.009551
-1.37	1.115975	0.997642
-1.07	0.833840	0.966714
-0.78	0.796354	0.879653
-0.48	0.671905	0.743938
-0.19	0.555234	0.600745
0.09	0.429237	0.355444
0.38	0.295180	0.211050
0.66	0.163366	0.102940
0.95	0.132468	0.041361
1.25	0.075091	0.011725
1.54	0.032283	0.0
1.82	0.018213	0.0
2.11	0.0	0.0
2.40	0.001662	0.0
2.74	0.0	0.0
3.09	0.243508	0.095554

Rep. 2, Time: 163200 s
CO H-3: 397.2 cpm/mL
CO Cl-36: 541.6 cpm/mL
Average Bulk Density.................2.1850 g/cc
Average Gravimetric Water Content...0.0710 g/g

50% Bentonite

L Bulk Density

Distance from interface (cm)	C / CO H-3	C / CO Cl-36
-4.51	1.025894	1.027687
-4.13	1.081966	1.075159
-3.73	0.0	0.0
-3.34	1.030360	1.023416
-2.96	0.871548	0.868204
-2.56	0.0	0.0
-2.18	1.068434	1.075293
-1.81	0.886580	0.860484
-1.43	0.769386	0.813204
-1.03	0.752219	0.707571
-0.63	0.747533	0.760062
-0.22	0.534496	0.523509
0.21	0.369538	0.449600
0.61	0.310668	0.309044
0.99	0.216246	0.211476
1.38	0.144088	0.129215
1.80	0.099232	0.091418
2.18	0.046889	0.043334
2.56	0.0	0.0
2.98	0.013340	0.012222
3.38	0.0	0.0
3.80	0.002895	0.002471
4.25	0.0	0.0

Rep. 1, Time: 95400 s
CO H-3: 4253.0 cpm/mL
CO Cl-36: 2610.0 cpm/mL
Average Bulk Density................0.9500 g/cc
Average Gravimetric Water Content...0.6370 g/g

50% Bentonite

L Bulk Density

Distance from interface (cm)	C / CO H-3	C / CO Cl-36
-4.43	0.0	0.0
-4.17	1.044314	1.040417
-3.76	0.951622	0.959169
-3.36	0.0	0.0
-2.95	0.991849	0.971074
-2.56	0.0	0.0
-2.16	0.909981	0.900208
-1.76	0.923931	0.925561
-1.35	0.896151	0.936548
-0.96	0.727513	0.733887
-0.57	0.680919	0.685330
-0.19	0.584917	0.613996
0.19	0.406135	0.399293
0.60	0.346883	0.354365
1.03	0.209804	0.202603
1.42	0.134197	0.124321
1.84	0.093076	0.089328
2.27	0.045015	0.041258
2.68	0.0	0.0
3.08	0.010481	0.008236
3.47	0.0	0.0
3.87	0.001369	0.001620
4.28	0.000456	0.000546
4.57	0.0	0.0

Rep. 2, Time: 93600 s
CO H-3: 4215.1 cpm/mL
CO Cl-36: 2561.9 cpm/mL
Average Bulk Density................0.9450 g/cc
Average Gravimetric Water Content...0.6180 g/g

50% Bentonite

M Bulk Density

Distance from interface (cm)	C / CO H-3	C / CO Cl-36
-4.40	1.006652	0.981404
-4.03	0.0	0.0
-3.63	1.079471	1.081140
-3.25	0.0	0.0
-2.90	0.988324	0.963200
-2.62	0.960947	0.897790
-2.32	1.074360	0.983524
-2.01	1.012603	0.966601
-1.71	0.875474	0.816936
-1.40	0.935937	0.873866
-1.09	0.769353	0.910392
-0.79	0.764239	0.926914
-0.47	0.645482	0.766887
-0.15	0.524740	0.511205
0.20	0.447110	0.549811
0.55	0.265826	0.253002
0.85	0.211927	0.137503
1.14	0.101178	0.079013
1.42	0.042641	0.029565
1.72	0.033695	0.019963
2.07	0.011076	0.003641
2.37	0.003937	0.000480
2.66	0.002818	0.0
2.98	0.002244	0.0
3.32	0.0	0.0
3.75	0.001962	0.0
4.15	0.000647	0.0
4.53	0.0	0.0

Rep. 1, Time: 81000 s
CO H-3: 1565.4 cpm/mL
CO Cl-36: 1249.8 cpm/mL
Average Bulk Density................1.4370 g/cc
Average Gravimetric Water Content...0.3060 g/g

50% Bentonite

M Bulk Density

Distance from interface (cm)	C / CO H-3	C / CO Cl-36
-4.23	0.994680	1.080492
-3.85	0.0	0.0
-3.44	1.047765	1.241652
-3.04	0.0	0.0
-2.71	1.007745	0.976299
-2.43	0.936943	0.887053
-2.15	0.992449	0.951215
-1.86	0.876738	0.762308
-1.55	0.925833	0.871430
-1.26	0.967058	0.910388
-0.96	0.905453	0.852428
-0.70	0.702352	0.634898
-0.46	0.630406	0.639708
-0.17	0.597789	0.576063
0.16	0.395096	0.336749
0.49	0.343000	0.301369
0.79	0.185918	0.168951
1.08	0.128687	0.099105
1.36	0.065913	0.044563
1.66	0.037892	0.027310
1.97	0.016075	0.009143
2.25	0.008545	0.005883
2.54	0.003830	0.004174
2.85	0.005424	0.002743
3.15	0.003184	0.001948
3.48	0.0	0.0
3.88	0.002949	0.002504
4.29	0.0	0.0
4.59	0.002662	0.000755

Rep. 2, Time: 83700 s
CO H-3: 1497.7 cpm/mL
CO Cl-36: 1257.8 cpm/mL.
Average Bulk Density................1.4530 g/cc
Average Gravimetric Water Content...0.3060 g/g

50% Bentonite

H Bulk Density

Distance from interface (cm)	C / C0 H-3	C / C0 Cl-36
-2.65	1.073543	0.906820
-2.31	0.0	0.0
-1.96	1.045669	1.201716
-1.66	0.0	0.0
-1.37	0.809983	0.841907
-1.07	1.094000	0.918049
-0.78	0.982435	0.909443
-0.49	0.783730	0.851742
-0.20	0.568235	0.542666
0.12	0.244188	0.347598
0.41	0.164808	0.170726
0.66	0.075703	0.118516
0.95	0.061413	0.032047
1.24	0.047023	0.009508
1.53	0.045979	0.006885
1.83	0.0	0.0
2.17	0.0	0.000574
2.86	0.0	0.0

Rep. 1, Time: 174300 s
C0 H-3: 495.1 cpm/mL
C0 Cl-36: 610.0 cpm/mL
Average Bulk Density.................1.9200 g/cc
Average Gravimetric Water Content...0.1390 g/g

50% Bentonite

H Bulk Density

Distance from interface (cm)	C / CO H-3	C / CO Cl-36
-2.88	0.0	0.0
-2.43	1.048523	1.359110
-2.15	1.407377	1.119486
-1.86	0.0	0.0
-1.57	1.438472	1.059890
-1.29	1.479145	1.161042
-1.00	1.595746	1.160403
-0.71	1.466953	0.802387
-0.42	1.224879	0.490607
-0.12	1.013039	0.278661
0.16	0.667205	0.131351
0.42	0.455575	0.052397
0.71	0.267736	0.018199
1.01	0.122314	0.003360
1.30	0.057004	0.000360
1.58	0.017116	0.000360
1.88	0.007017	0.000560
2.16	0.0	0.0
2.43	0.0	0.001040
2.78	0.0	0.0
3.14	0.0	0.002560

Rep. 2, Time: 166500 s
CO H-3: 288.3 cpm/mL
CO Cl-36: 1250.1 cpm/mL
Average Bulk Density................1.9590 g/cc
Average Gravimetric Water Content...0.1360 g/g

75% Bentonite

L Bulk Density

Distance from interface (cm)	C / CO H-3	C / CO Cl-36
-4.45	0.0	0.0
-4.22	1.010177	0.977347
-3.82	0.905879	1.003983
-3.42	0.0	0.0
-3.01	1.004772	0.973978
-2.62	0.0	0.0
-2.22	0.935383	0.963619
-1.81	0.988020	0.962496
-1.41	0.798208	0.753164
-1.02	0.762448	0.803619
-0.63	0.822053	0.759986
-0.22	0.643927	0.667473
0.16	0.408167	0.397862
0.52	0.308272	0.343836
0.92	0.236502	0.227671
1.29	0.149259	0.131218
1.68	0.104532	0.092396
2.09	0.047562	0.038923
2.50	0.0	0.0
2.89	0.012208	0.009856
3.28	0.005907	0.004593
3.68	0.0	0.0
4.09	0.001099	0.001173
4.38	0.0	0.0

Rep. 1, Time: 90000 s
CO H-3: 4656.7 cpm/mL
CO Cl-36: 2982.8 cpm/mL
Average Bulk Density..... ....0.7910 g/cc
Average Gravimetric Water Content...0.8480 g/g

75% Bentonite

L Bulk Density

Distance from interface (cm)	C / CO H-3	C / CO Cl-36
-4.42	0.0	0.0
-4.19	1.078789	1.051584
-3.79	0.999673	0.980210
-3.38	0.0	0.0
-2.98	0.855260	0.880880
-2.61	0.0	0.0
-2.23	0.985096	0.962747
-1.85	0.975220	0.915911
-1.44	0.944013	0.932481
-1.05	0.844620	0.859196
-0.65	0.0	0.0
-0.23	0.681168	0.645212
0.25	0.349782	0.481987
0.67	0.223800	0.251135
1.03	0.138786	0.140263
1.43	0.126505	0.127074
1.84	0.074076	0.064124
2.23	0.042148	0.030442
2.62	0.0	0.0
3.02	0.008290	0.005079
3.41	0.0	0.0
3.79	0.001669	0.000841
4.20	0.000928	0.000158
4.44	0.0	0.0

Rep. 2, Time: 92700 s
CO H-3: 4510.5 cpm/mL
CO Cl-36: 2854.6 cpm/mL
Average Bulk Density................0.8100 g/cc
Average Gravimetric Water Content...0.7930 g/g

75% Bentonite

H Bulk Density

Distance from interface (cm)	C / CO H-3	C / CO Cl-36
-2.52	0.0	0.0
-2.09	0.951984	1.035439
-1.72	0.0	0.0
-1.34	1.102385	1.022591
-1.06	1.021239	0.904145
-0.79	0.831442	0.819402
-0.51	0.563998	0.564777
-0.22	0.497632	0.615948
0.07	0.294229	0.388999
0.36	0.341429	0.248641
0.64	0.180315	0.139698
0.91	0.142991	0.073699
1.18	0.0	0.0
1.47	0.020985	0.013508
1.77	0.011727	0.005060
2.10	0.0	0.0
2.48	0.006760	0.002200

Rep. 1, Time: 179100 s
CO H-3: 1037.2 cpm/mL
CO Cl-36: 1136.4 cpm/mL
Average Bulk Density................1.5800 g/cc
Average Gravimetric Water Content...0.2600 g/g

75% Bentonite

H Bulk Density

Distance from interface (cm)	C / CO H-3	C / CO Cl-36
-2.72	1.309509	1.369495
-2.36	0.0	0.0
-2.07	0.844908	0.799915
-1.83	0.860432	0.899422
-1.55	0.0	0.0
-1.29	0.776930	0.780484
-1.06	0.799803	0.804839
-0.80	0.826690	0.865573
-0.54	0.724044	0.761319
-0.25	0.673722	0.717355
0.01	0.325341	0.337915
0.26	0.354188	0.315379
0.53	0.190303	0.139700
0.80	0.154050	0.089126
1.06	0.0	0.0
1.30	0.047726	0.014862
1.56	0.026712	0.006255
1.81	0.011376	0.003815
2.05	0.000750	0.000311
2.53	0.0	0.0

Rep. 2, Time: 181188 s
CO H-3: 1098.7 cpm/mL
CO Cl-36: 1127.1 cpm/mL
Average Bulk Density................1.6620 g/cc
Average Gravimetric Water Content...0.2640 g/g

100% Bentonite

L Bulk Density

Distance from interface (cm)	C / CO H-3	C / CO Cl-36
-4.38	1.052472	1.045267
-3.96	0.954479	0.962959
-3.56	0.0	0.0
-3.15	0.919196	0.916679
-2.73	0.0	0.0
-2.33	0.911103	0.919726
-1.93	0.915789	0.920034
-1.52	0.831427	0.850469
-1.13	0.735643	0.771069
-0.75	0.676996	0.680187
-0.28	0.725377	0.755724
0.21	0.446640	0.451268
0.64	0.348648	0.327958
1.07	0.226631	0.212159
1.50	0.141237	0.119939
1.92	0.098303	0.080031
2.35	0.065953	0.051235
2.76	0.0	0.0
3.15	0.021250	0.015468
3.56	0.0	0.0
3.97	0.005484	0.003463
4.38	0.0	0.0

Rep. 1, Time: 93600 s
CO H-3: 5491.1 cpm/mL
CO Cl-36: 3248.7 cpm/mL
Average Bulk Density................0.5480 g/cc
Average Gravimetric Water Content...1.3490 g/g

100% Bentonite

L Bulk Density

Distance from interface (cm)	C / CO H-3	C / CO Cl-36
-4.36	0.0	0.0
-3.94	1.013639	1.021566
-3.53	0.0	0.0
-3.12	0.908842	0.906864
-2.72	0.0	0.0
-2.33	0.909862	0.933139
-1.91	0.940770	0.905172
-1.45	0.931139	0.946221
-1.02	0.778112	0.787368
-0.58	0.751204	0.757423
-0.16	0.497045	0.491050
0.21	0.442600	0.451629
0.59	0.301157	0.299546
0.96	0.252621	0.242440
1.35	0.137082	0.123482
1.73	0.107702	0.097760
2.18	0.068134	0.063149
2.61	0.0	0.0
2.99	0.016885	0.013399
3.39	0.0	0.0
3.80	0.003368	0.003116
4.22	0.002228	0.001914

Rep. 2, Time: 81000 s
CO H-3: 5439.0 cpm/mL
CO Cl-36: 3160.8 cpm/mL
Average Bulk Density................0.5420 g/cc
Average Gravimetric Water Content...1.4260 g/g

100% Bentonite

H Bulk Density

Distance from interface (cm)	C / CO H-3	C / CO Cl-36
-2.60	0.0	0.0
-2.16	1.007215	1.096399
-1.87	0.0	0.0
-1.56	1.079066	1.103701
-1.26	0.924928	0.999629
-0.98	0.962590	1.065339
-0.67	0.875739	0.930826
-0.36	0.757241	0.727839
-0.06	0.484123	0.410180
0.20	0.315158	0.196552
0.46	0.235271	0.115992
0.74	0.166334	0.054572
1.04	0.085002	0.013777
1.34	0.045185	0.003052
1.66	0.0	0.0
1.97	0.007478	0.0
2.28	0.0	0.0
2.59	0.003660	0.0

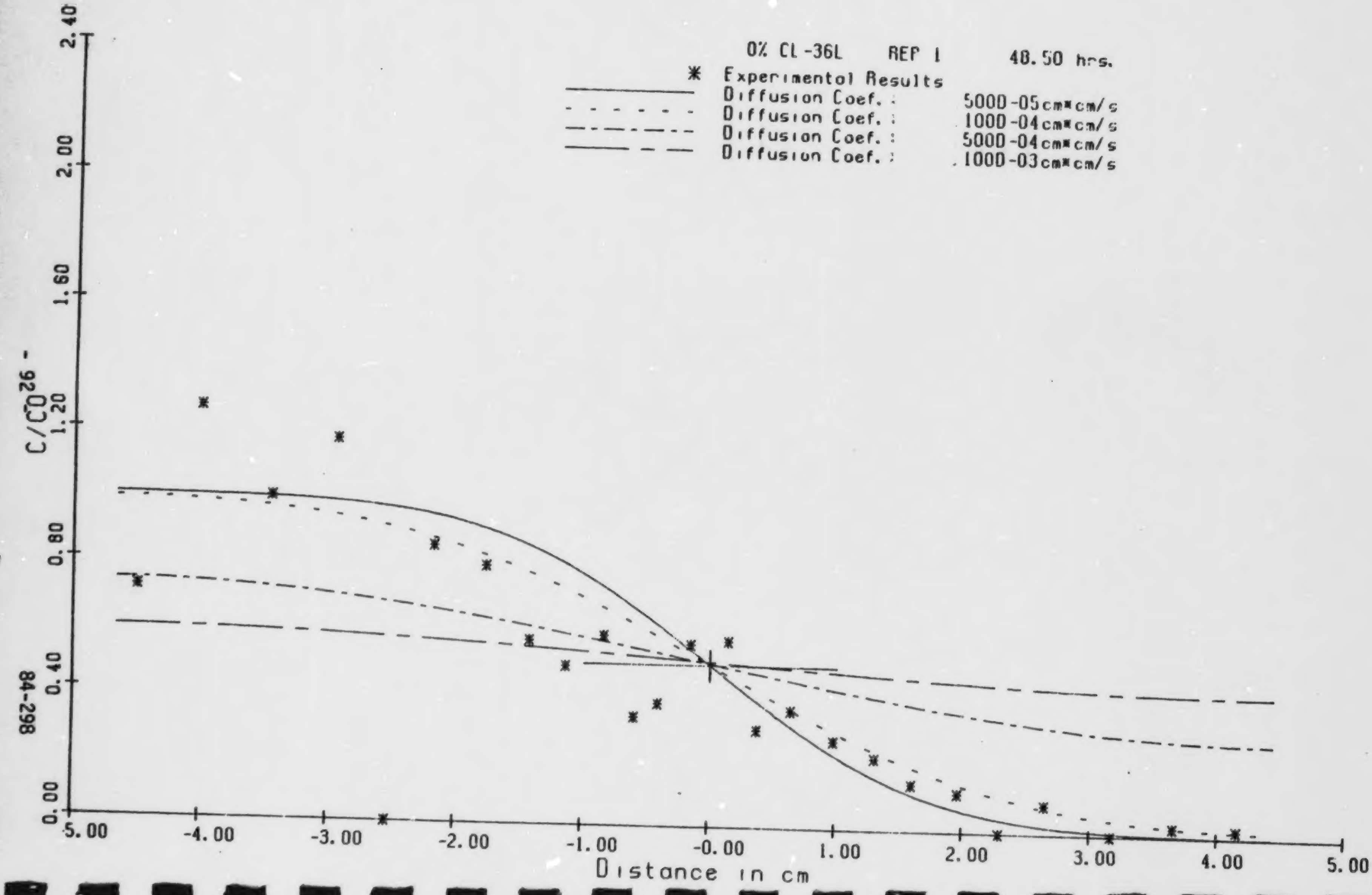
Rep. 1, Time: 156600 s
CO H-3: 787.6 cpm/mL
CO Cl-36: 1212.1 cpm/mL
Average Bulk Density.................1.4390 g/cc
Average Gravimetric Water Content...0.2880 g/g

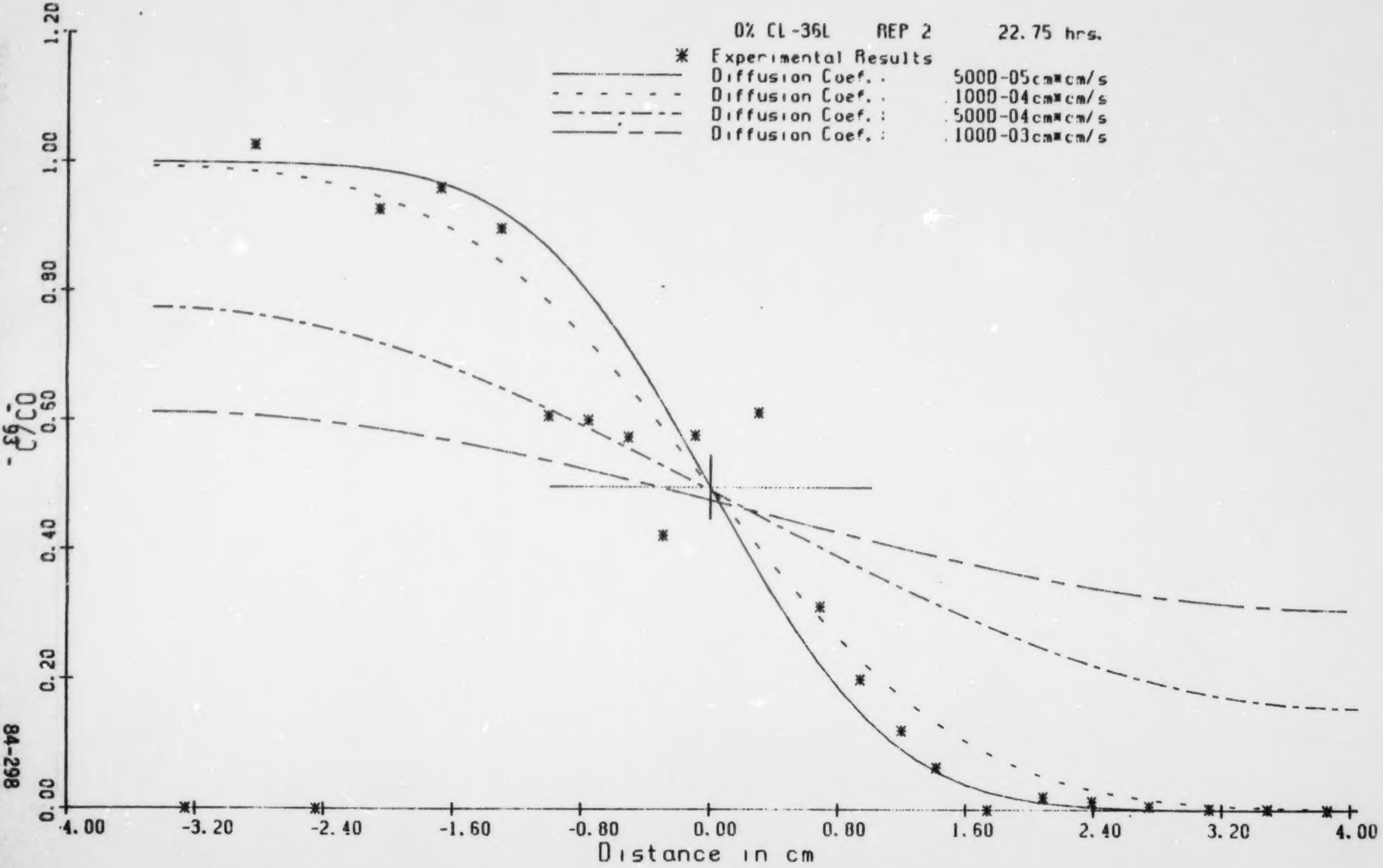
100% Bentonite

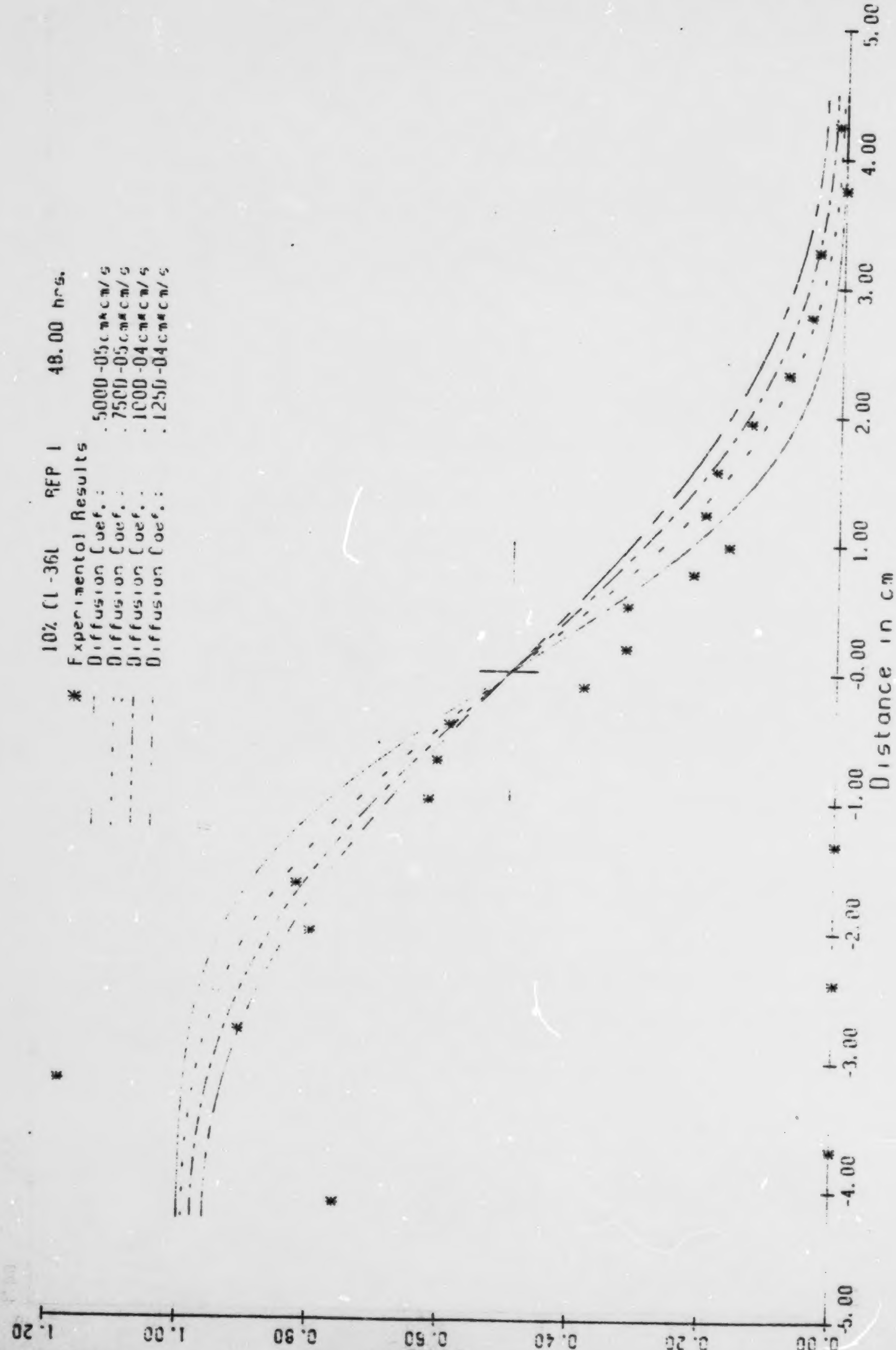
H Bulk Density

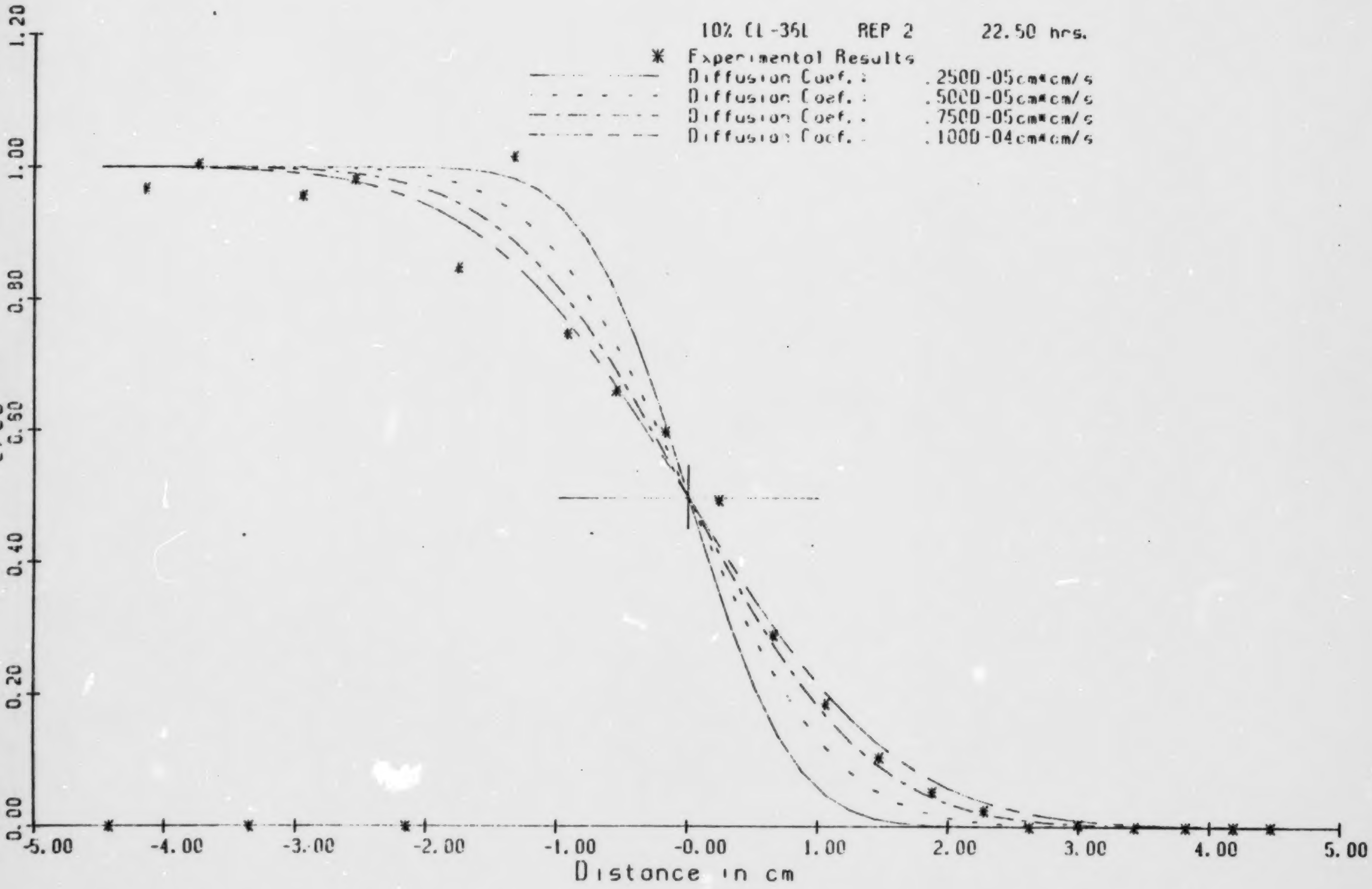
Distance from interface (cm)	C / CO H-3	C / CO Cl-36
-3.18	1.142450	1.353679
-2.75	0.0	0.0
-2.37	0.912735	1.055889
-2.06	0.0	0.0
-1.75	0.919260	1.017854
-1.42	0.857969	0.872057
-1.11	0.764617	0.715468
-0.78	0.805393	0.714875
-0.44	0.720365	0.620839
-0.12	0.547483	0.458144
0.19	0.458847	0.363663
0.53	0.354048	0.212885
0.86	0.212835	0.083986
1.18	0.125325	0.032758
1.49	0.062688	0.010672
1.79	0.0	0.0
2.11	0.016594	0.003587
2.45	0.007146	0.001690
2.76	0.000785	0.001868
3.07	0.001712	0.002638
3.60	0.0	0.0

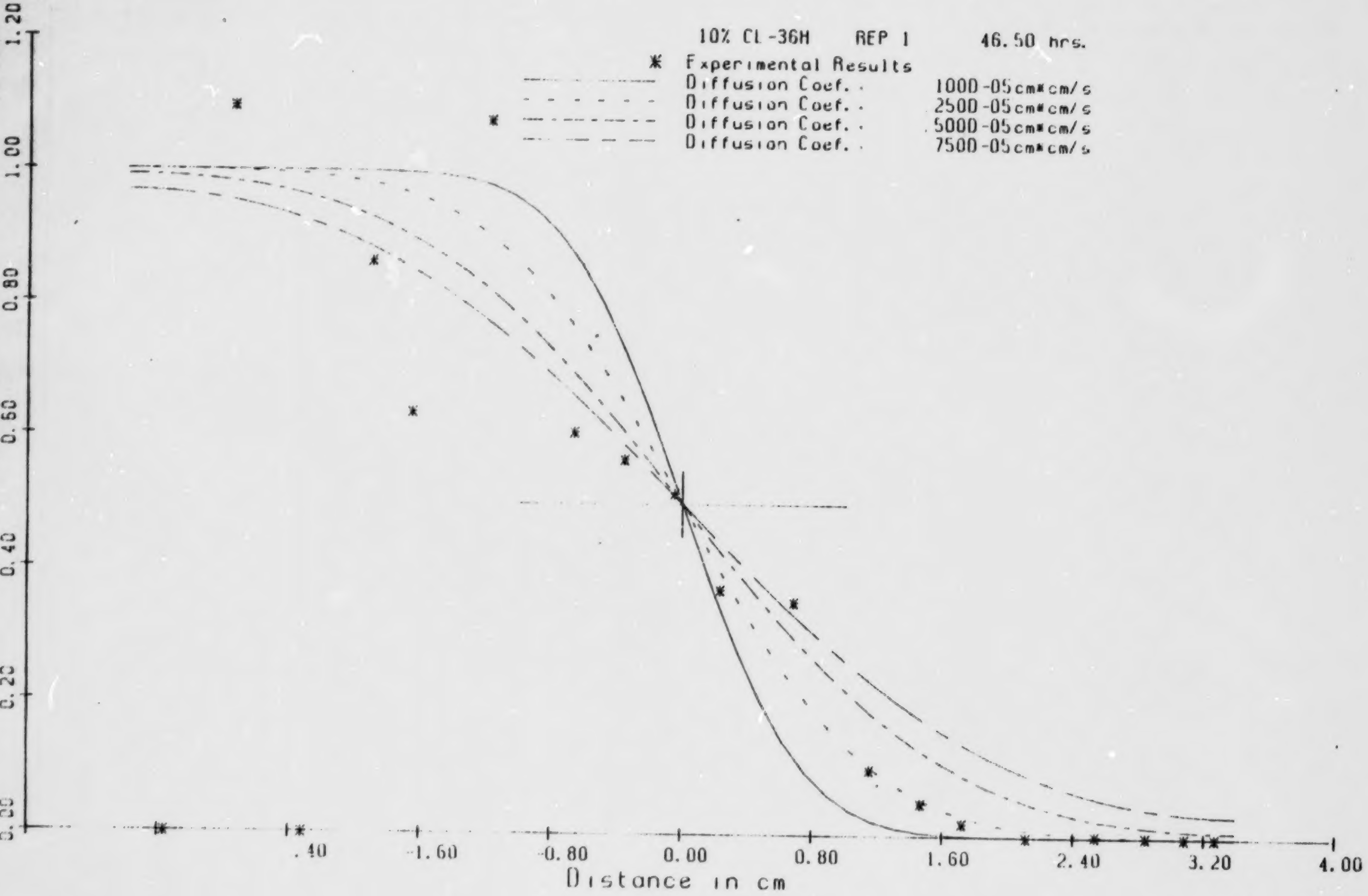
Rep. 2, Time: 182412 s
CO H-3: 1009.1 cpm/mL
CO Cl-36: 1686.6 cpm/mL
Average Bulk Density................1.3450 g/cc
Average Gravimetric Water Content...0.2880 g/g

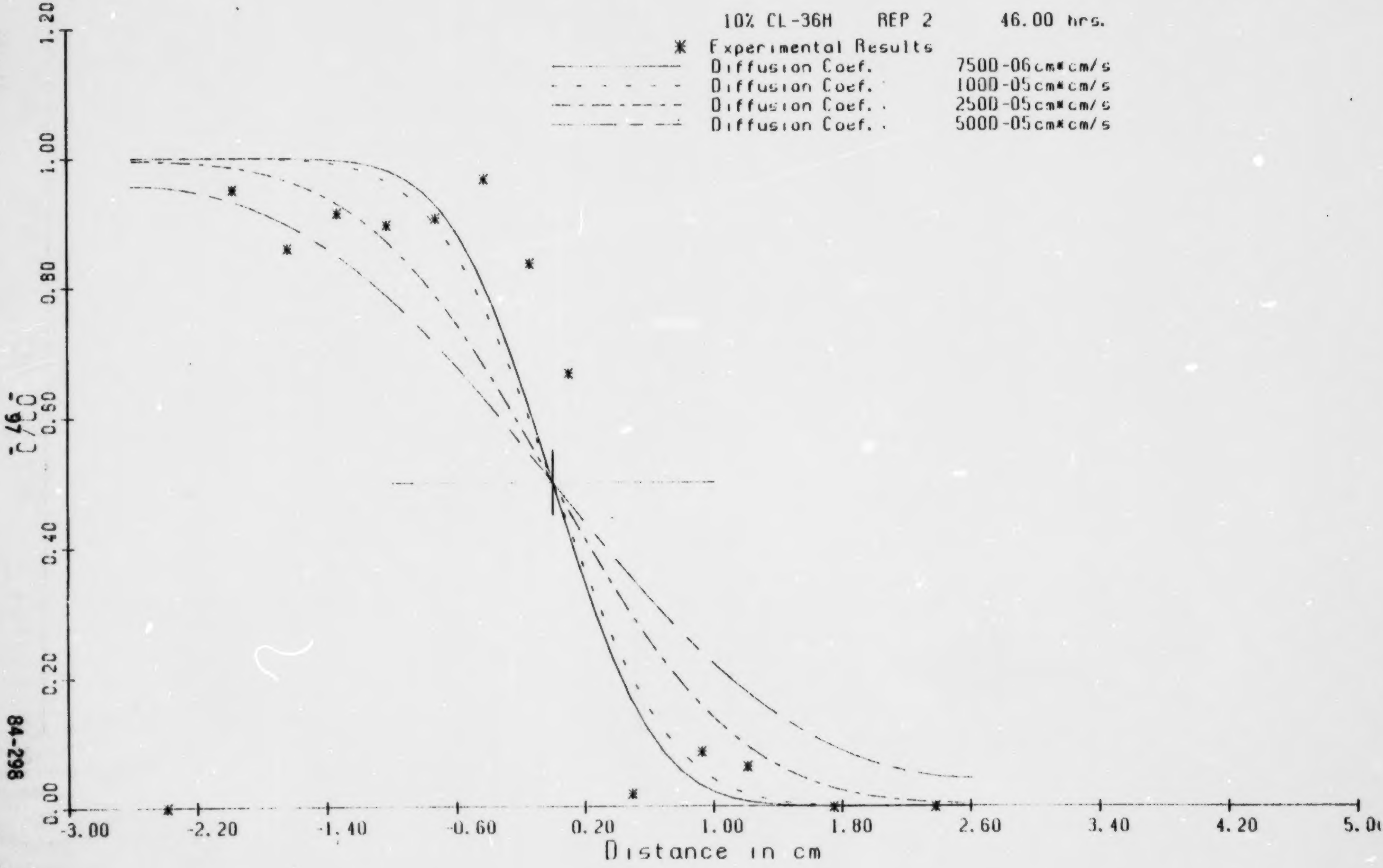

0% CL-36L REP 1 48.50 hrs.
Experimentol Results
Diffusion Coef. : 5000-05cm*cm/s
Diffusion Coef. : 1000-04cm*cm/s
Diffusion Coef. : 5000-04cm*cm/s
Diffusion Coef. : 1000-03cm*cm/s
C/CO 26 -
2.40
2.00
1.60
1.20
0.80
0.40
0.00
84-298
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

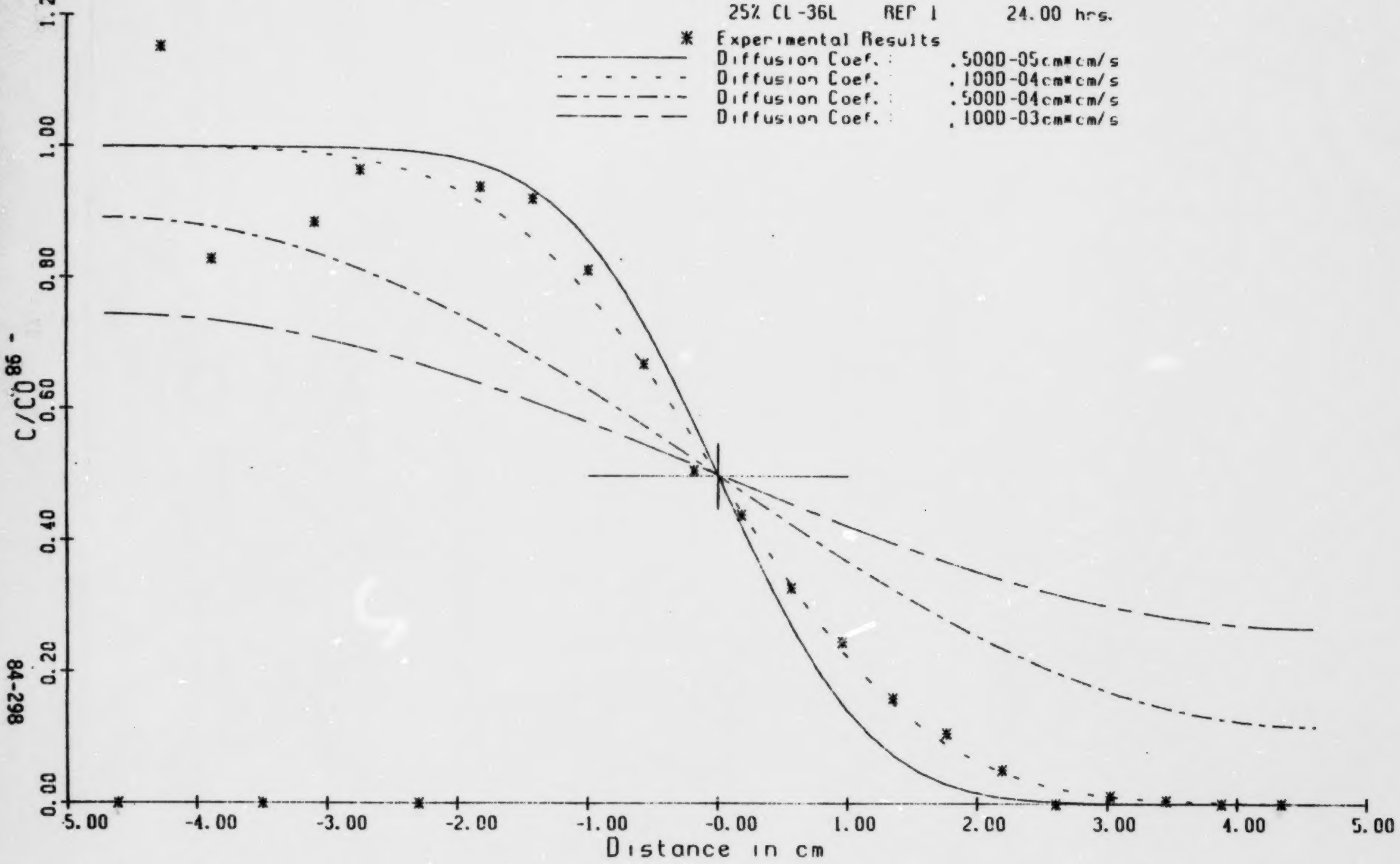

0% CL-36L REP 2 22.75 hrs.
Experimental Results
Diffusion Coef. . .5000-05cm*cm/s
Diffusion Coef. . .1000-04cm*cm/s
Diffusion Coef. : .5000-04cm*cm/s
Diffusion Coef. : .1000-03cm*cm/s
C/CO
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-4.00
-3.20
-2.40
-1.60
-0.80
0.00
0.80
1.60
2.40
3.20
4.00
Distance in cm

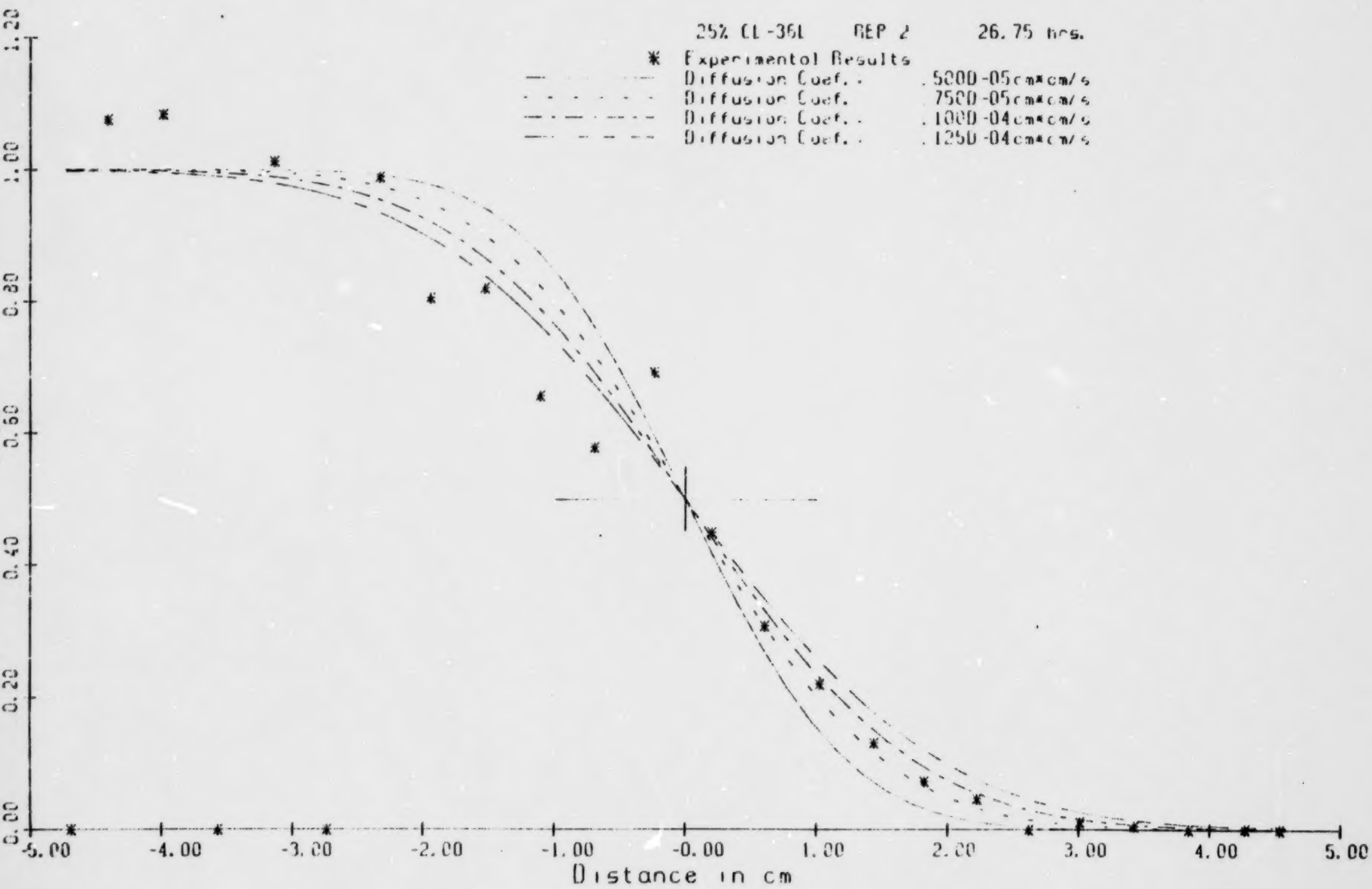
10% Cl-36L REP I 48.00 hrs.
* Experimental Results
Diffusion Coef.: .5000D-05cm*cm/s
Diffusion Coef.: .7500D-05cm*cm/s
Diffusion Coef.: .1000D-04cm*cm/s
Diffusion Coef.: .1250D-04cm*cm/s
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

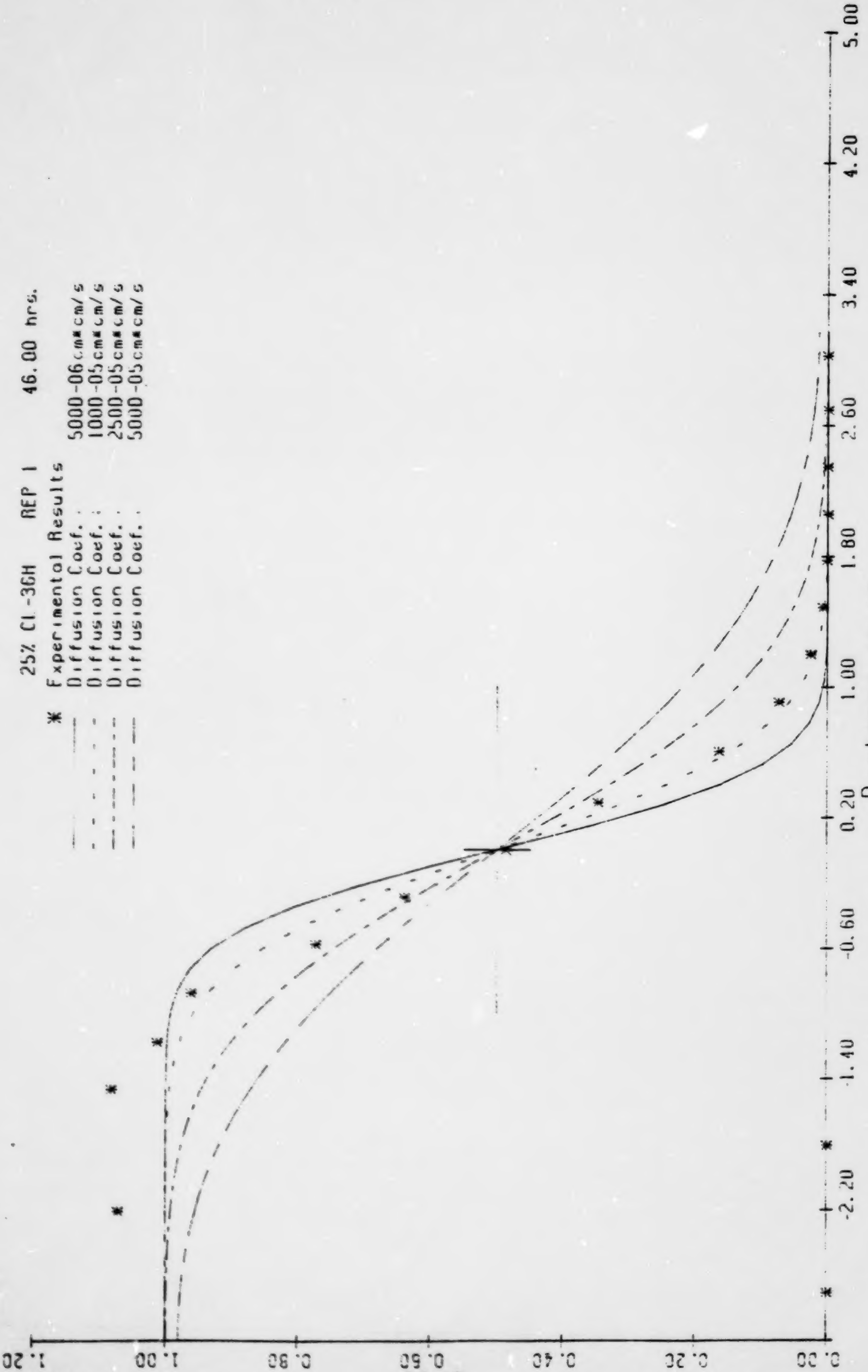

10% CL-36L REP 2 22.50 hrs.
* Experimental Results
Diffusion Coef.: .2500-05cm*cm/s
Diffusion Coef.: .5000-05cm*cm/s
Diffusion Coef.: .7500-05cm*cm/s
Diffusion Coef.: .1000-04cm*cm/s
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

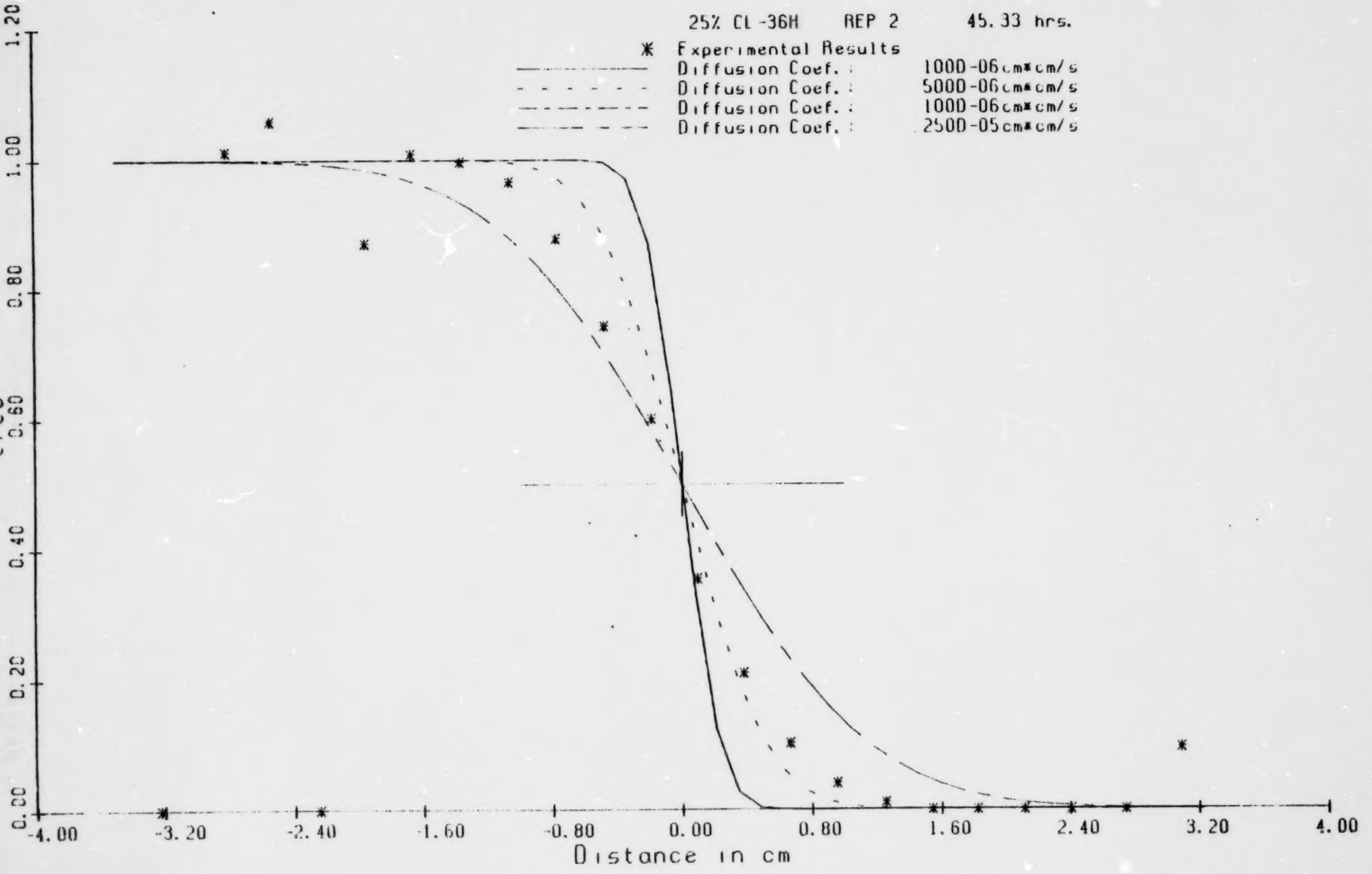

10% CL-36H REP 1 46.50 hrs.
Fxperimental Results
Diffusion Coef. . 1000-05cm*cm/s
Diffusion Coef. . 2500-05cm*cm/s
Diffusion Coef. . 5000-05cm*cm/s
Diffusion Coef. . 7500-05cm*cm/s
1.20
1.00
0.80
0.60
0.40
0.20
0.00
.40
-1.60
-0.80
0.00
0.80
1.60
2.40
3.20
4.00
Distance in cm
C/C0

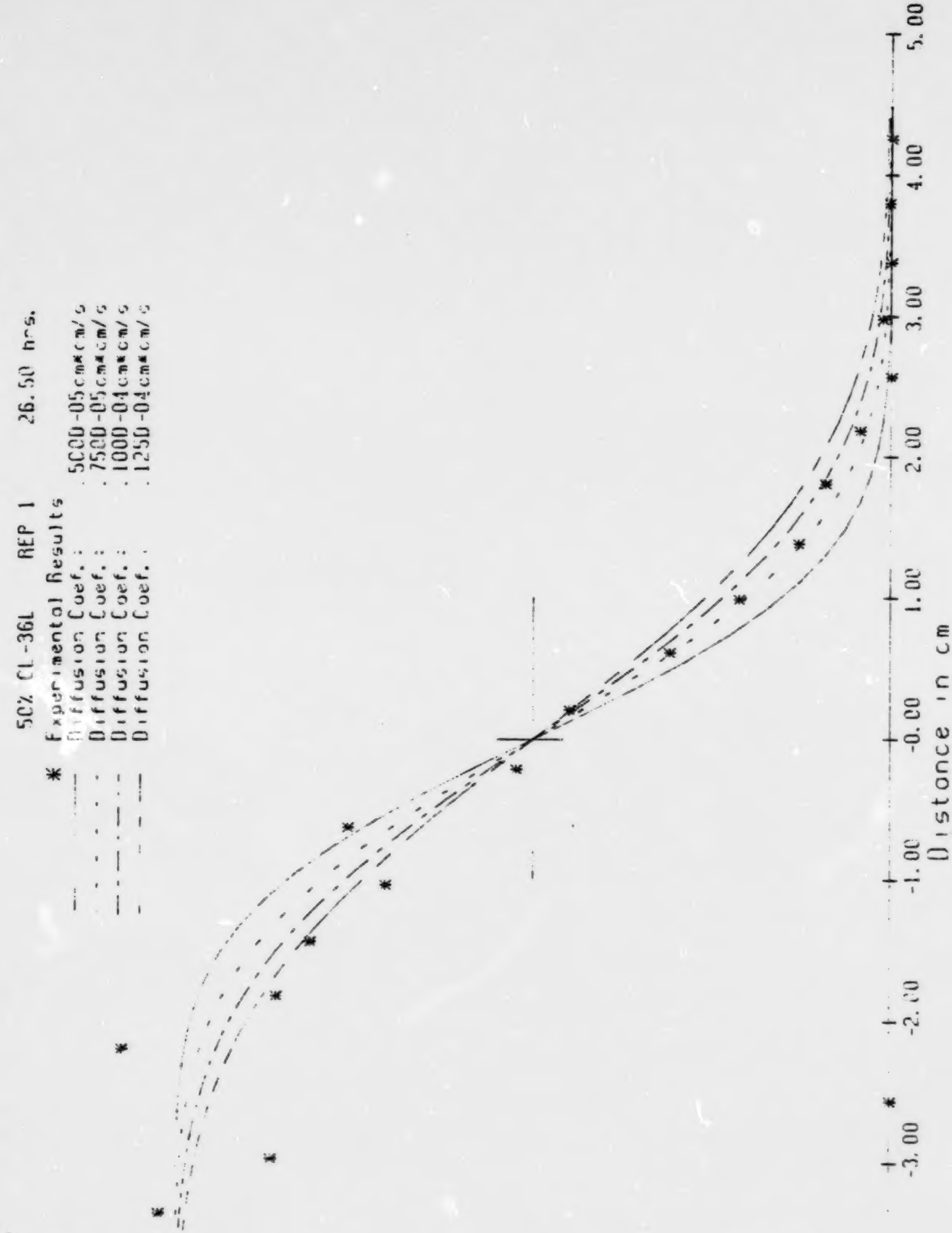

10% CL-36H REP 2 46.00 hrs.
Experimental Results
Diffusion Coef. 7500-06cm*cm/s
Diffusion Coef. 1000-05cm*cm/s
Diffusion Coef. 2500-05cm*cm/s
Diffusion Coef. 5000-05cm*cm/s
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-3.00
-2.20
-1.40
-0.60
0.20
1.00
1.80
2.60
3.40
4.20
5.0
Distance in cm

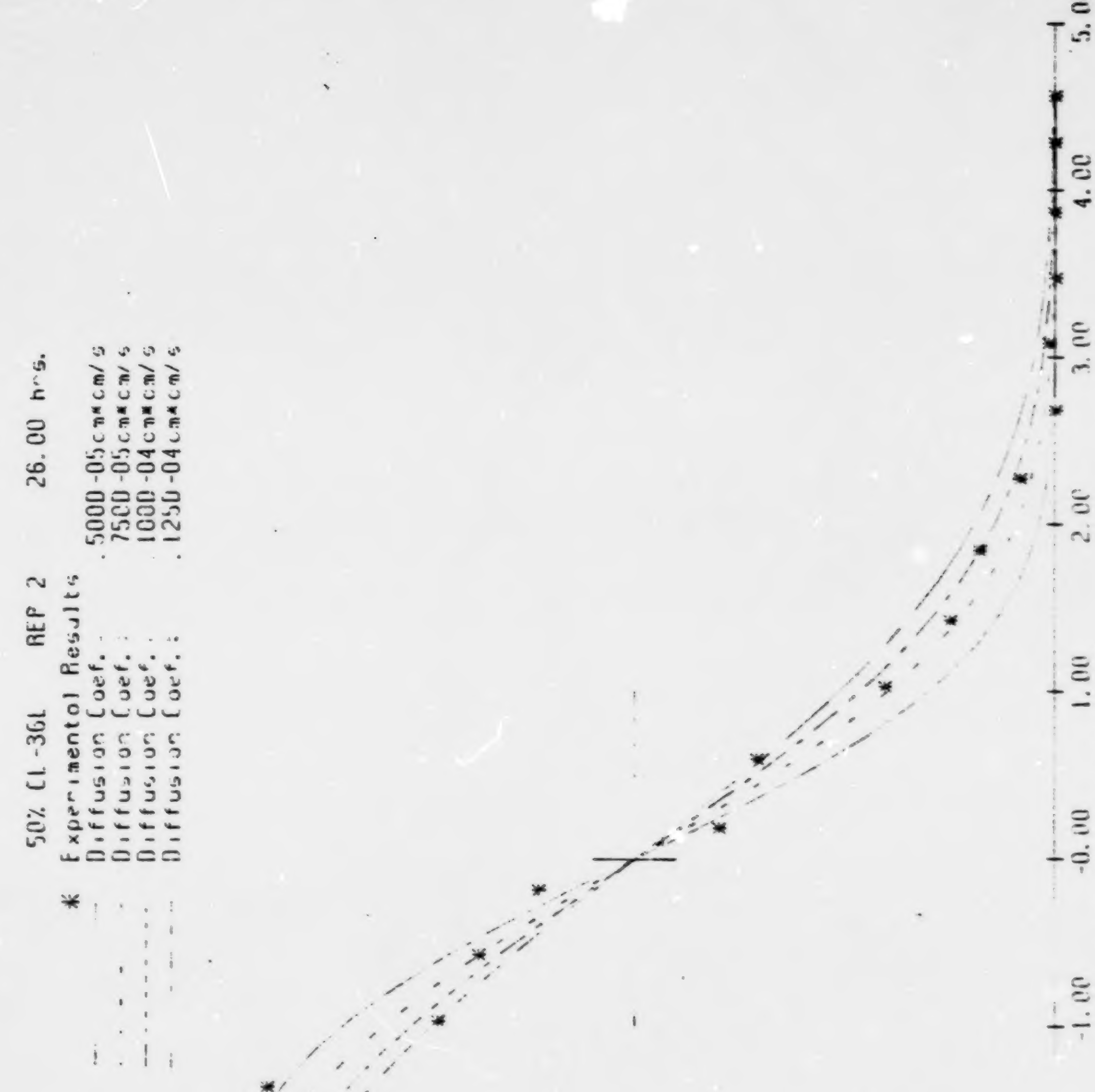

25% CL-36L REP 1 24.00 hrs.
Experimental Results
Diffusion Coef. : .5000-05cm*cm/s
Diffusion Coef. : .1000-04cm*cm/s
Diffusion Coef. : .5000-04cm*cm/s
Diffusion Coef. : .1000-03cm*cm/s
C/C0
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

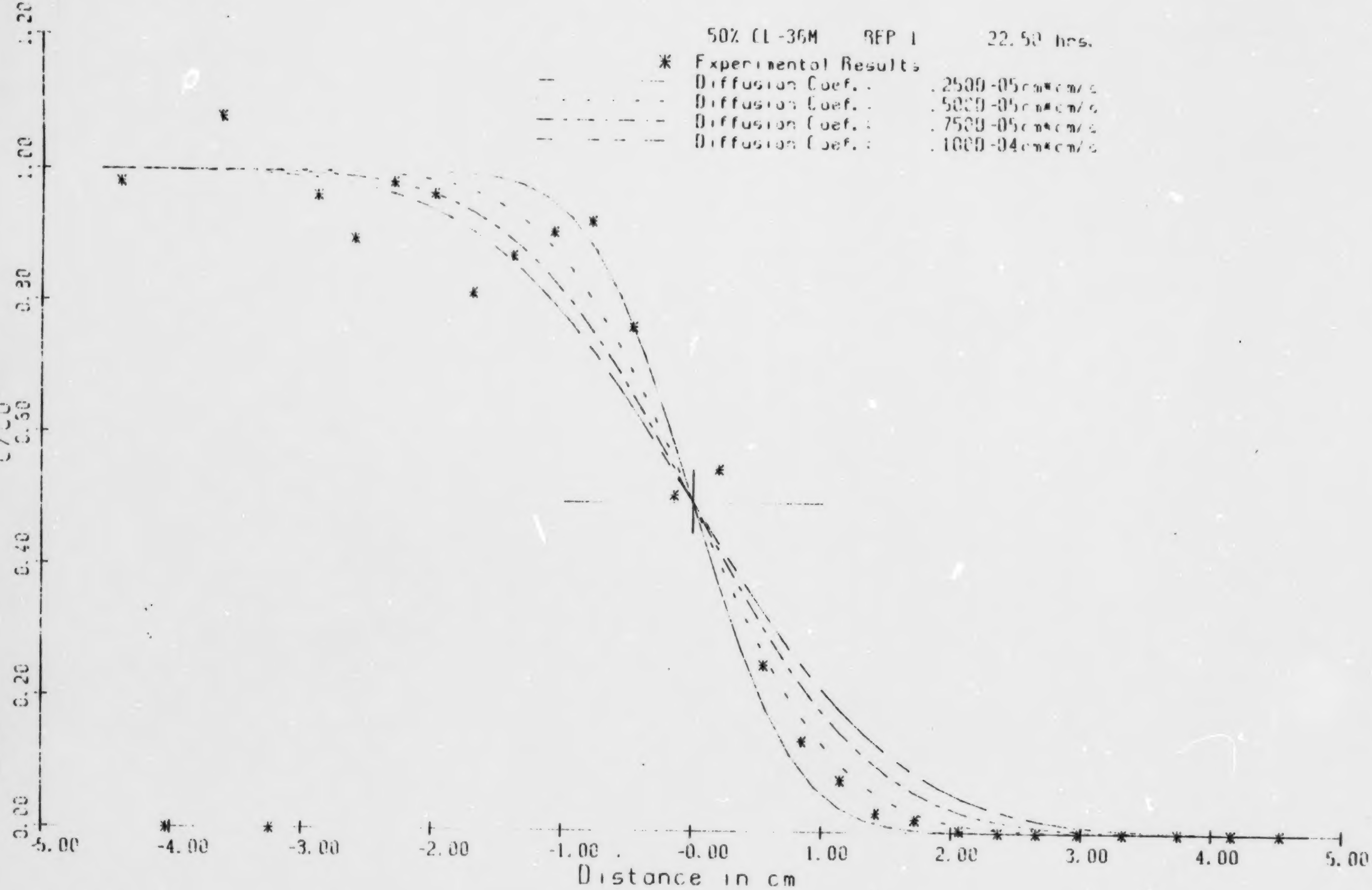

25% CL-36L REP 2 26.75 hrs.
Experimentol Results
Diffusion Coef. . .5000-05cm*cm/s
Diffusion Coef. .7500-05cm*cm/s
Diffusion Coef. . .1000-04cm*cm/s
Diffusion Coef. . .1250-04cm*cm/s
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

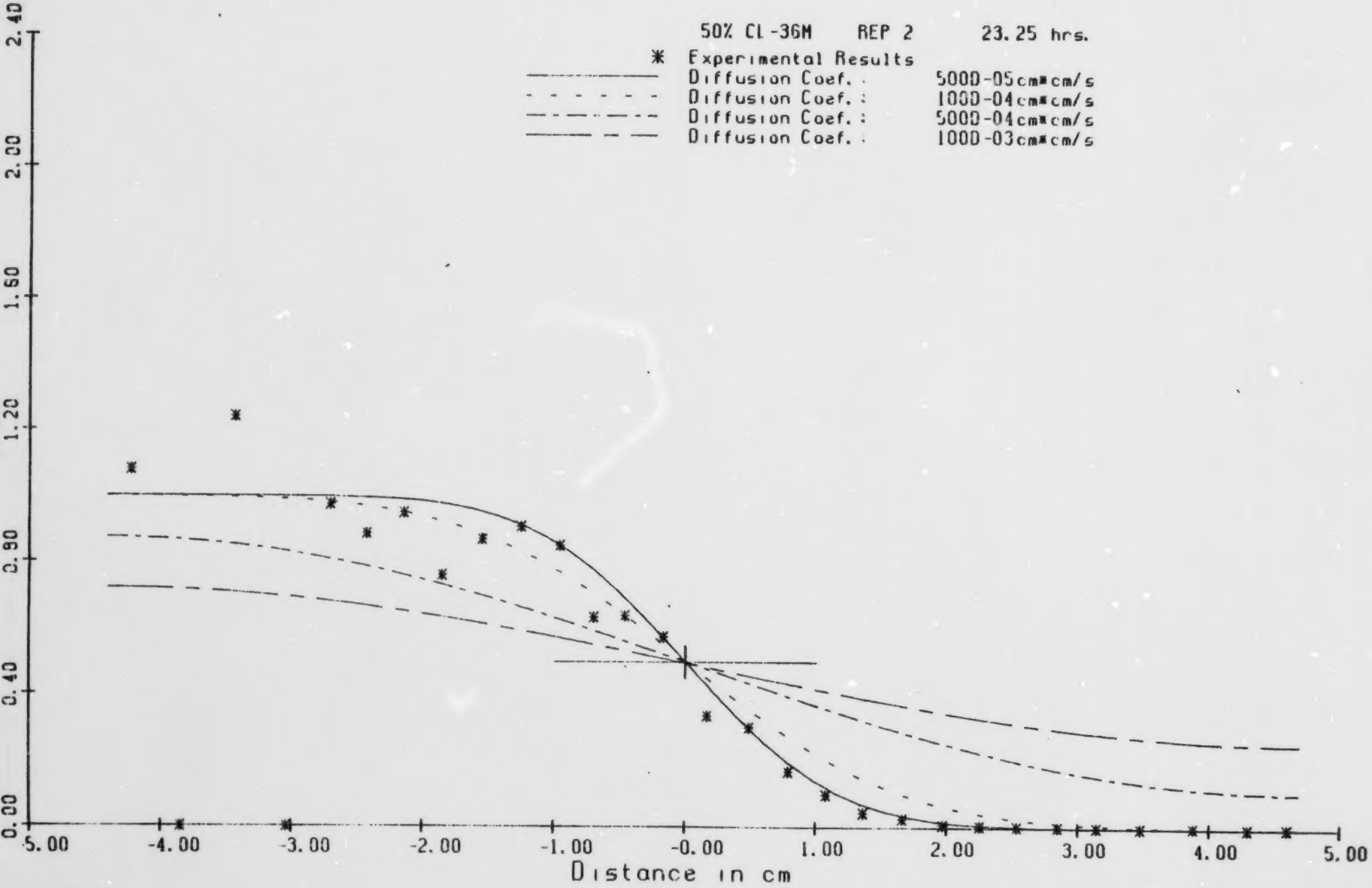

25% Cl-36H REP 1 46.00 hrs.
* Experimental Results
Diffusion Coef. : 5000D-06cm*cm/s
Diffusion Coef. : 1000D-05cm*cm/s
Diffusion Coef. : 2500D-05cm*cm/s
Diffusion Coef. : 5000D-05cm*cm/s
Distance in cm
-2.20
-1.40
-0.60
0.20
1.00
1.80
2.60
3.40
4.20
5.00
0.00
0.20
0.40
0.60
0.80
1.00
1.20
C/C0

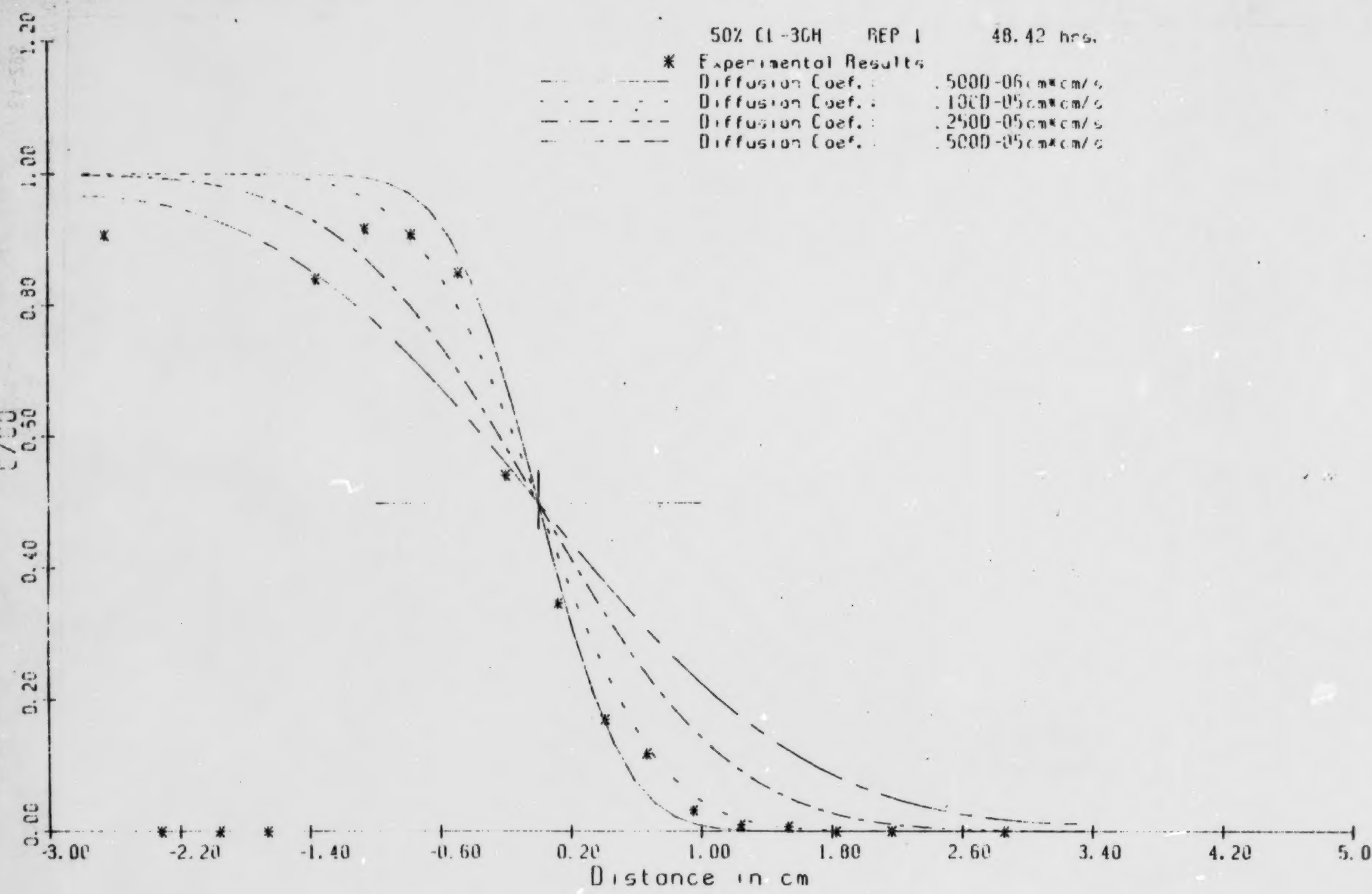
25% CL-36H REP 2 45.33 hrs.
Experimental Results
Diffusion Coef. : 1000-06cm*cm/s
Diffusion Coef. : 5000-06cm*cm/s
Diffusion Coef. : 1000-06cm*cm/s
Diffusion Coef. : 2500-05cm*cm/s
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-4.00
-3.20
-2.40
-1.60
-0.80
0.00
0.80
1.60
2.40
3.20
4.00
Distance in cm

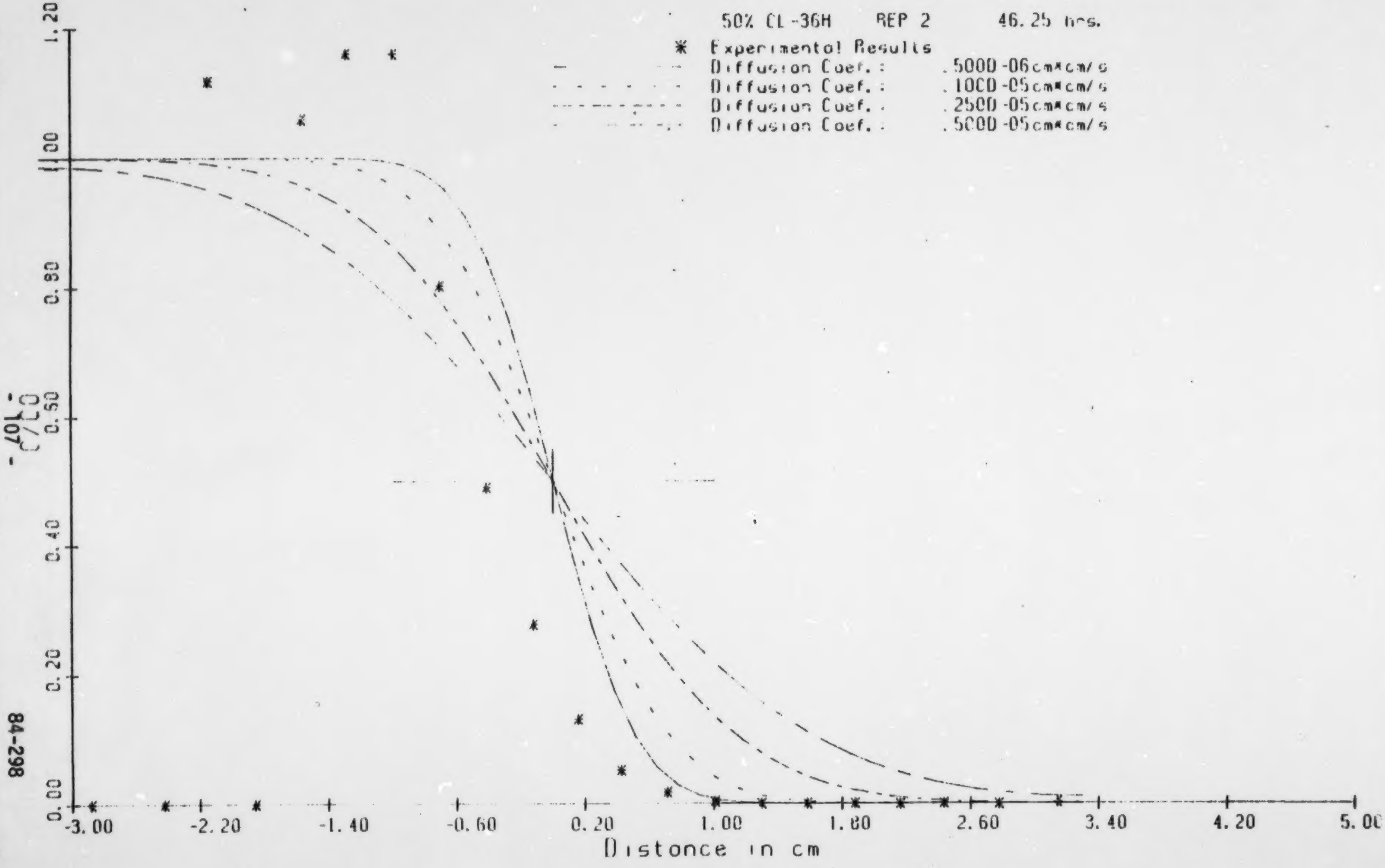

50% CL-36L REP 1 26.50 hrs.
Experimental Results
Diffusion Coef.: .5000-05cm*cm/s
Diffusion Coef.: .7500-05cm*cm/s
Diffusion Coef.: .1000-04cm*cm/s
Diffusion Coef.: .1250-04cm*cm/s
Distance in cm
C/C0
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
0.00
0.20
0.40
0.60
0.80
1.00
1.20

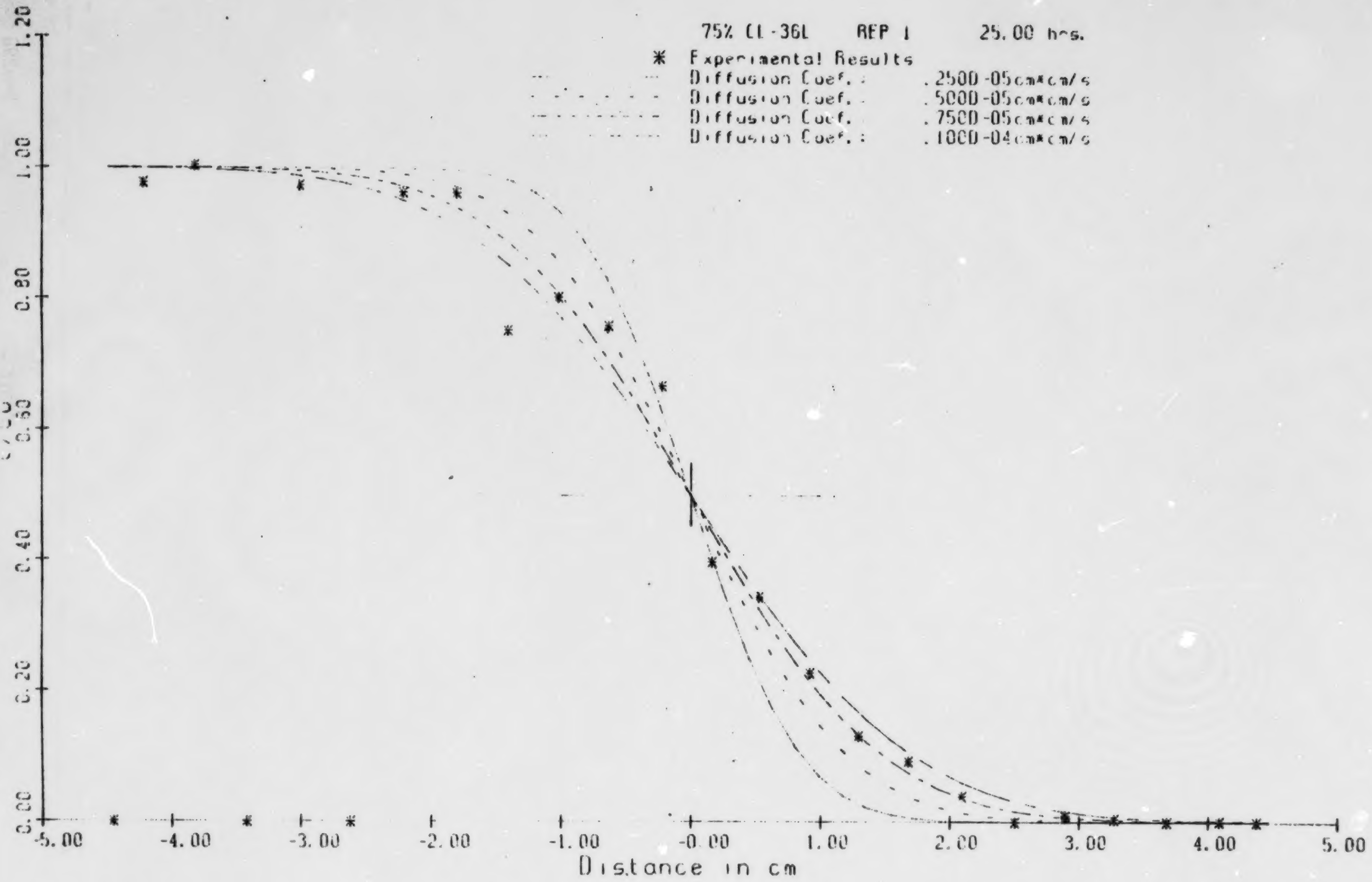

50% CL-36L REP 2 26.00 hrs.
* Experimental Results
Diffusion Coef. .5000D-05cm*cm/s
Diffusion Coef. .7500D-05cm*cm/s
Diffusion Coef. .1000D-04cm*cm/s
Diffusion Coef. .1250D-04cm*cm/s
C/Co
0.00
0.20
0.40
0.60
0.80
1.00
1.20
Distance in cm
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00

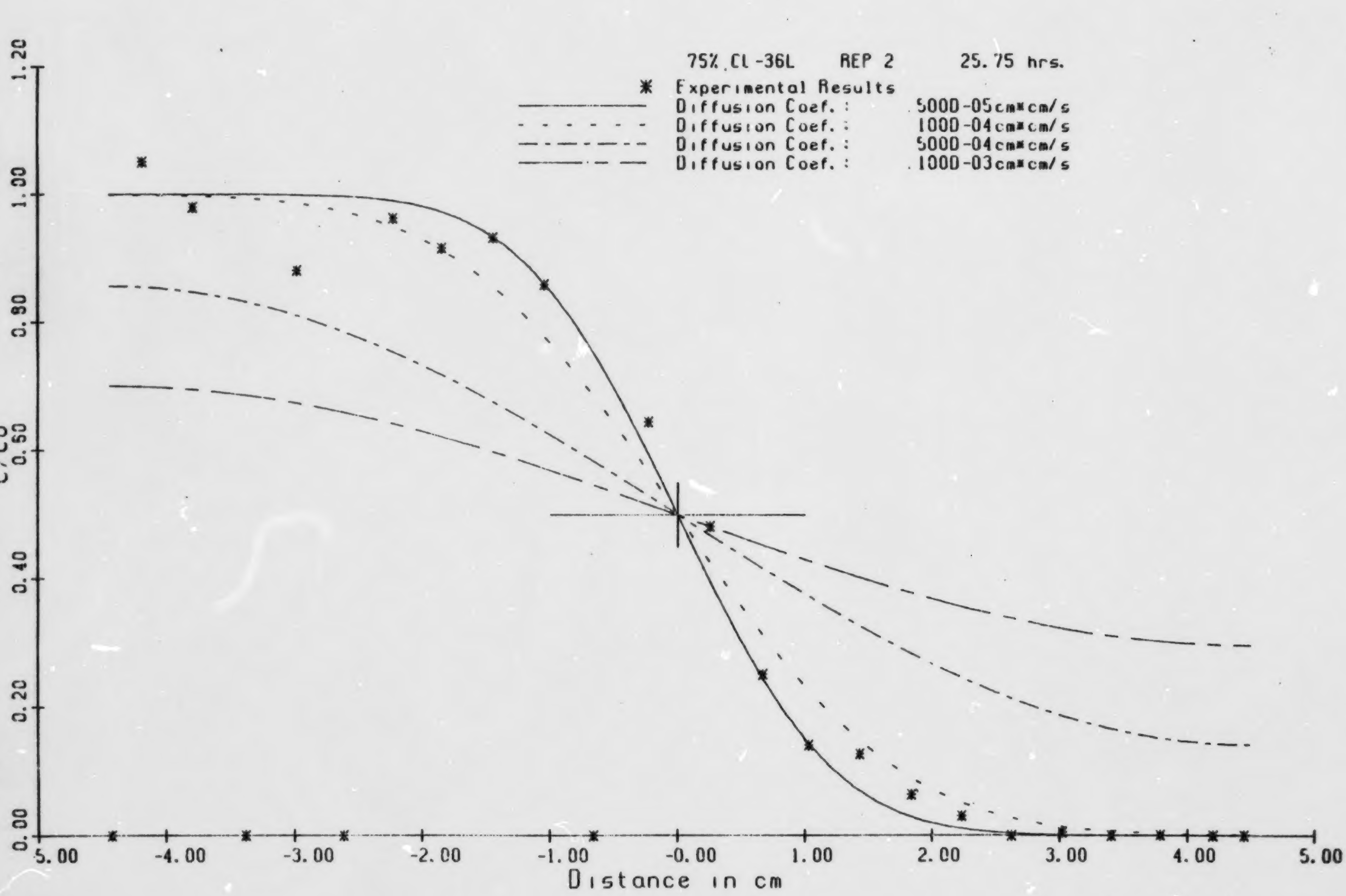

50% CL-36M REP 1 22.50 hrs.
* Experimental Results
Diffusion Coef.: .2500-05cm*cm/s
Diffusion Coef.: .5000-05cm*cm/s
Diffusion Coef.: .7500-05cm*cm/s
Diffusion Coef.: .1000-04cm*cm/s
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm


50% CL-36M REP 2 23.25 hrs.
Experimental Results
Diffusion Coef. : 5000-05cm*cm/s
Diffusion Coef. : 1000-04cm*cm/s
Diffusion Coef. : 5000-04cm*cm/s
Diffusion Coef. : 1000-03cm*cm/s
C/C0
0.00
0.40
0.80
1.20
1.60
2.00
2.40
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

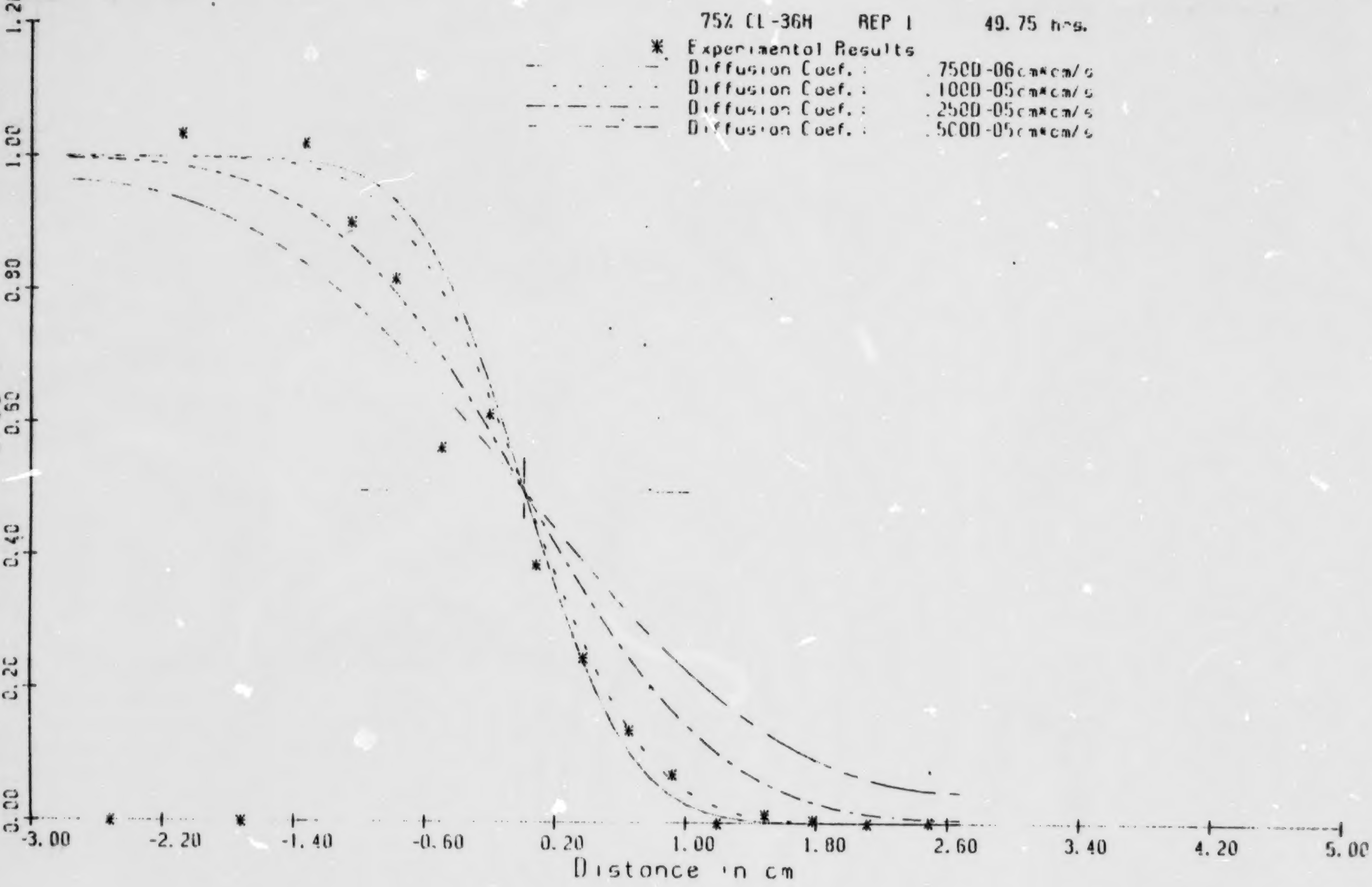

50% CL-3GH REP 1 48.42 hrs.
* Experimental Results
Diffusion Coef.: .5000-06cm*cm/s
Diffusion Coef.: .1000-05cm*cm/s
Diffusion Coef.: .2500-05cm*cm/s
Diffusion Coef.: .5000-05cm*cm/s
C/C0
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-3.00
-2.20
-1.40
-0.60
0.20
1.00
1.80
2.60
3.40
4.20
5.00
Distance in cm

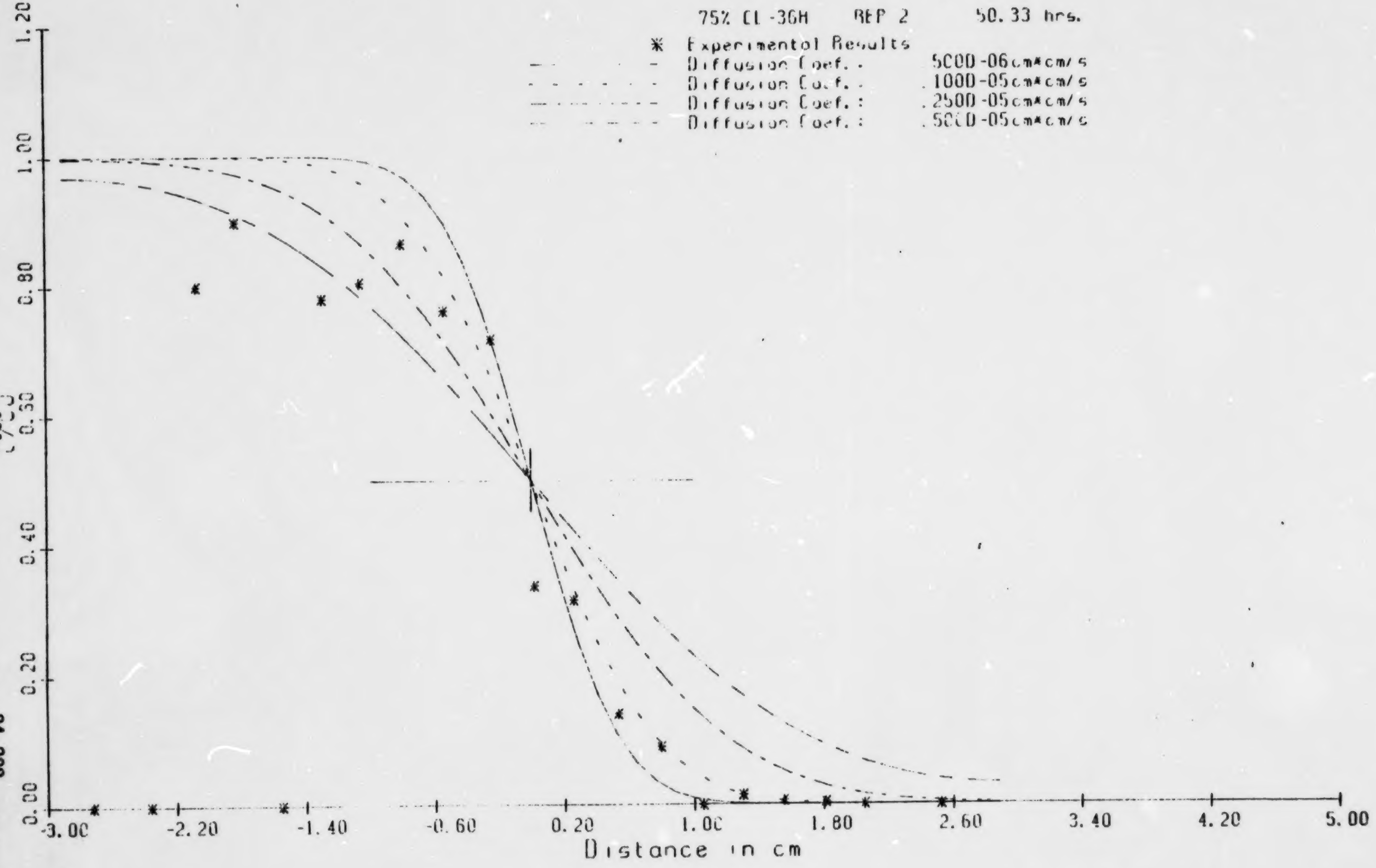

50% CL-36H REP 2 46.25 hrs.
* Experimental Results
Diffusion Coef.: .5000-06cm*cm/s
Diffusion Coef.: .1000-05cm*cm/s
Diffusion Coef.: .2500-05cm*cm/s
Diffusion Coef.: .5000-05cm*cm/s
C/C0
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-3.00
-2.20
-1.40
-0.60
0.20
1.00
1.80
2.60
3.40
4.20
5.00
Distance in cm


75% CL-36L REP 1 25.00 hrs.
Experimental Results
Diffusion Coef.: .2500-05cm*cm/s
Diffusion Coef.: .5000-05cm*cm/s
Diffusion Coef.: .7500-05cm*cm/s
Diffusion Coef.: .1000-04cm*cm/s
C/C0
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

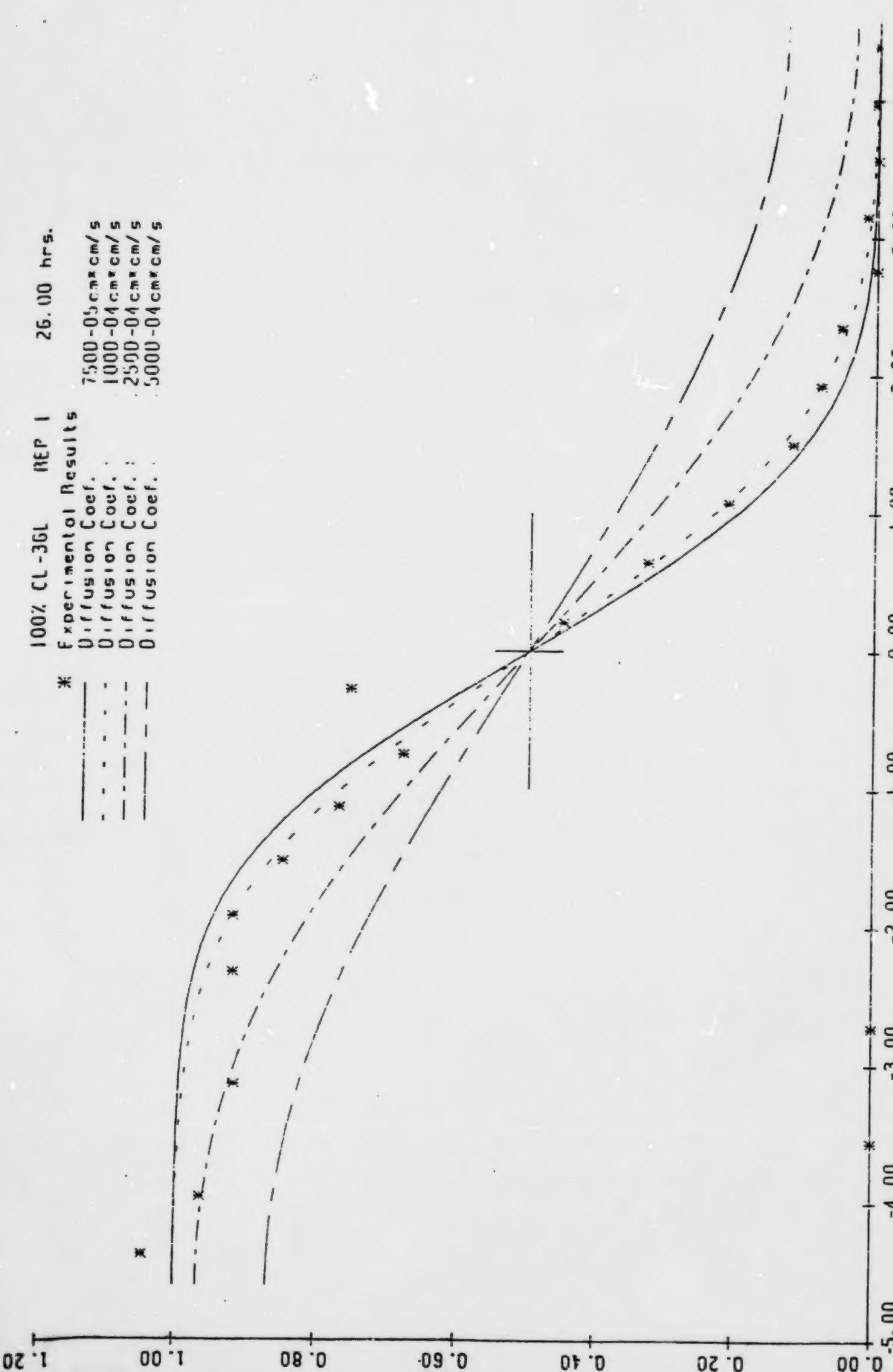

75% Cl-36L REP 2 25.75 hrs.
✱ Experimental Results
Diffusion Coef. : .5000-05cm✱cm/s
Diffusion Coef. : .1000-04cm✱cm/s
Diffusion Coef. : .5000-04cm✱cm/s
Diffusion Coef. : .1000-03cm✱cm/s
1.20
1.00
0.80
0.60
0.40
0.20
0.00
C/CO
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

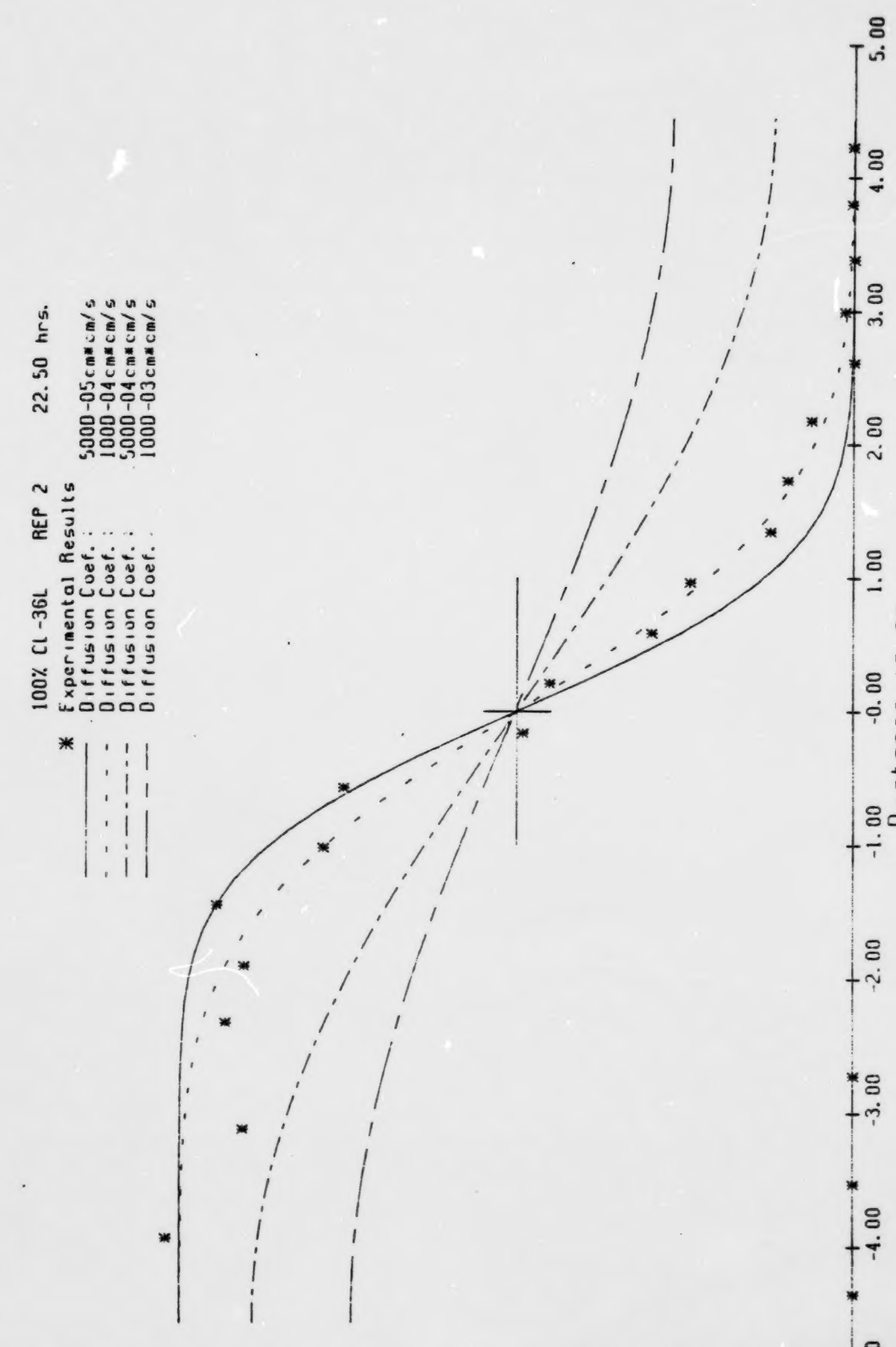
84-298


75% CL-36H REP I 49.75 hrs.
Experimental Results
Diffusion Coef. : .750D-06cm*cm/s
Diffusion Coef. : .100D-05cm*cm/s
Diffusion Coef. : .250D-05cm*cm/s
Diffusion Coef. : .500D-05cm*cm/s
C/Co
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-3.00
-2.20
-1.40
-0.60
0.20
1.00
1.80
2.60
3.40
4.20
5.00
Distance in cm

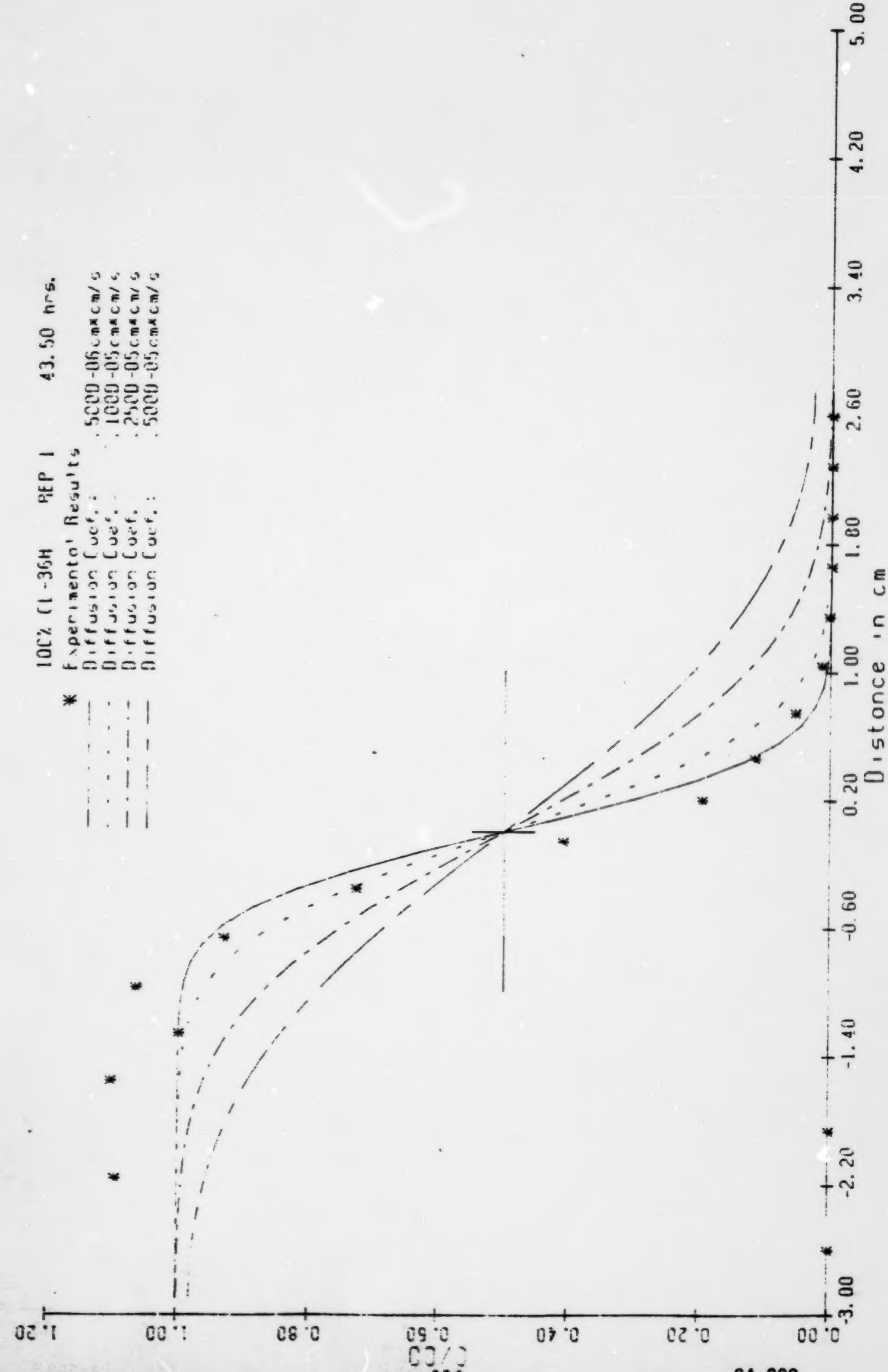


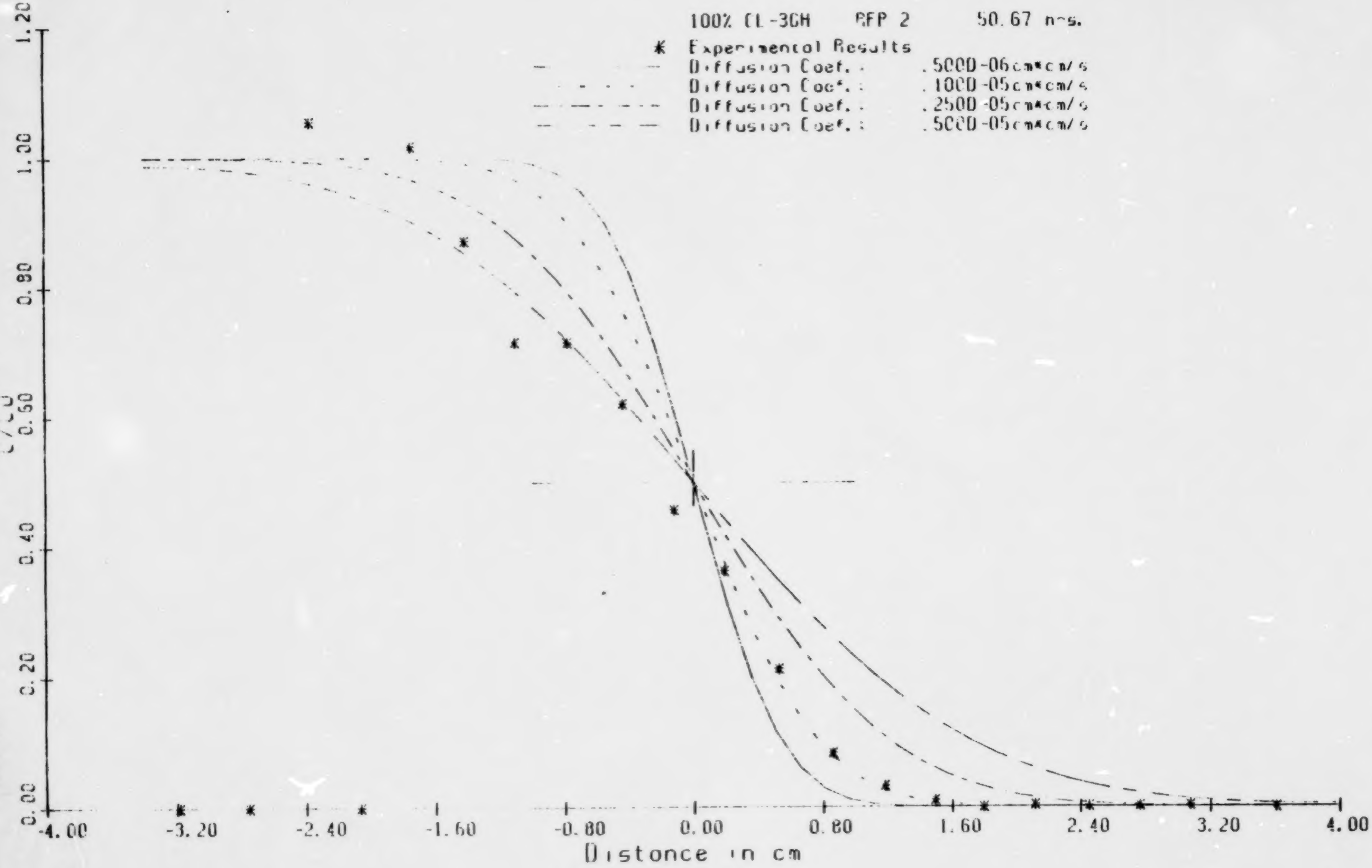
75% CL-36H REP 2 50.33 hrs.
* Experimental Results
Diffusion Coef.: .5000-06cm*cm/s
Diffusion Coef.: .1000-05cm*cm/s
Diffusion Coef.: .2500-05cm*cm/s
Diffusion Coef.: .5000-05cm*cm/s
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-3.00
-2.20
-1.40
-0.60
0.20
1.00
1.80
2.60
3.40
4.20
5.00
Distance in cm

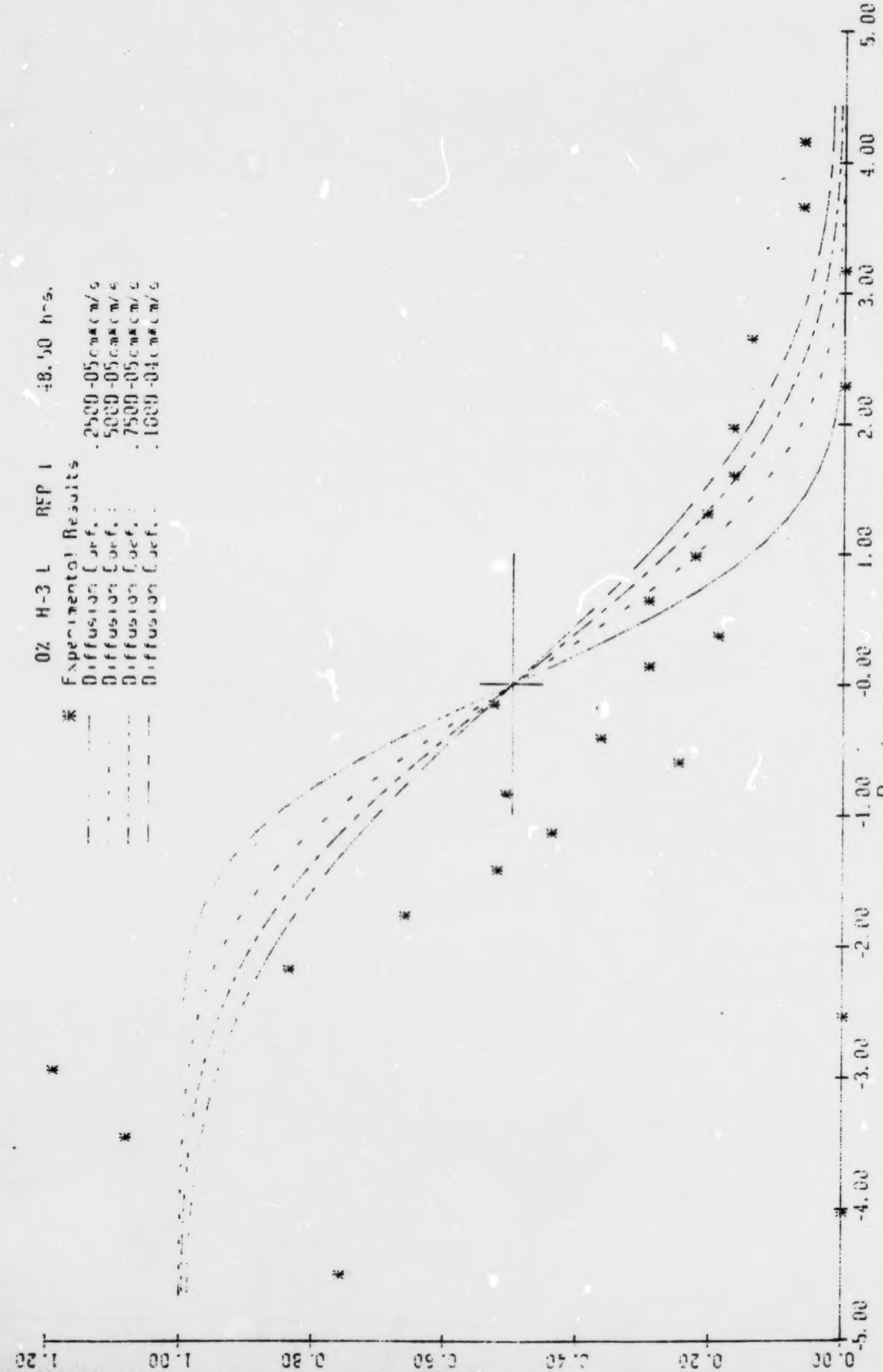

100% CL-3GL REP 1 26.00 hrs.
* Experimental Results
Diffusion Coef. 7500-05cm*cm/s
Diffusion Coef. 1000-04cm*cm/s
Diffusion Coef. 2500-04cm*cm/s
Diffusion Coef. 5000-04cm*cm/s
C/CO
0.00
0.20
0.40
0.60
0.80
1.00
1.20
Distance in cm
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00

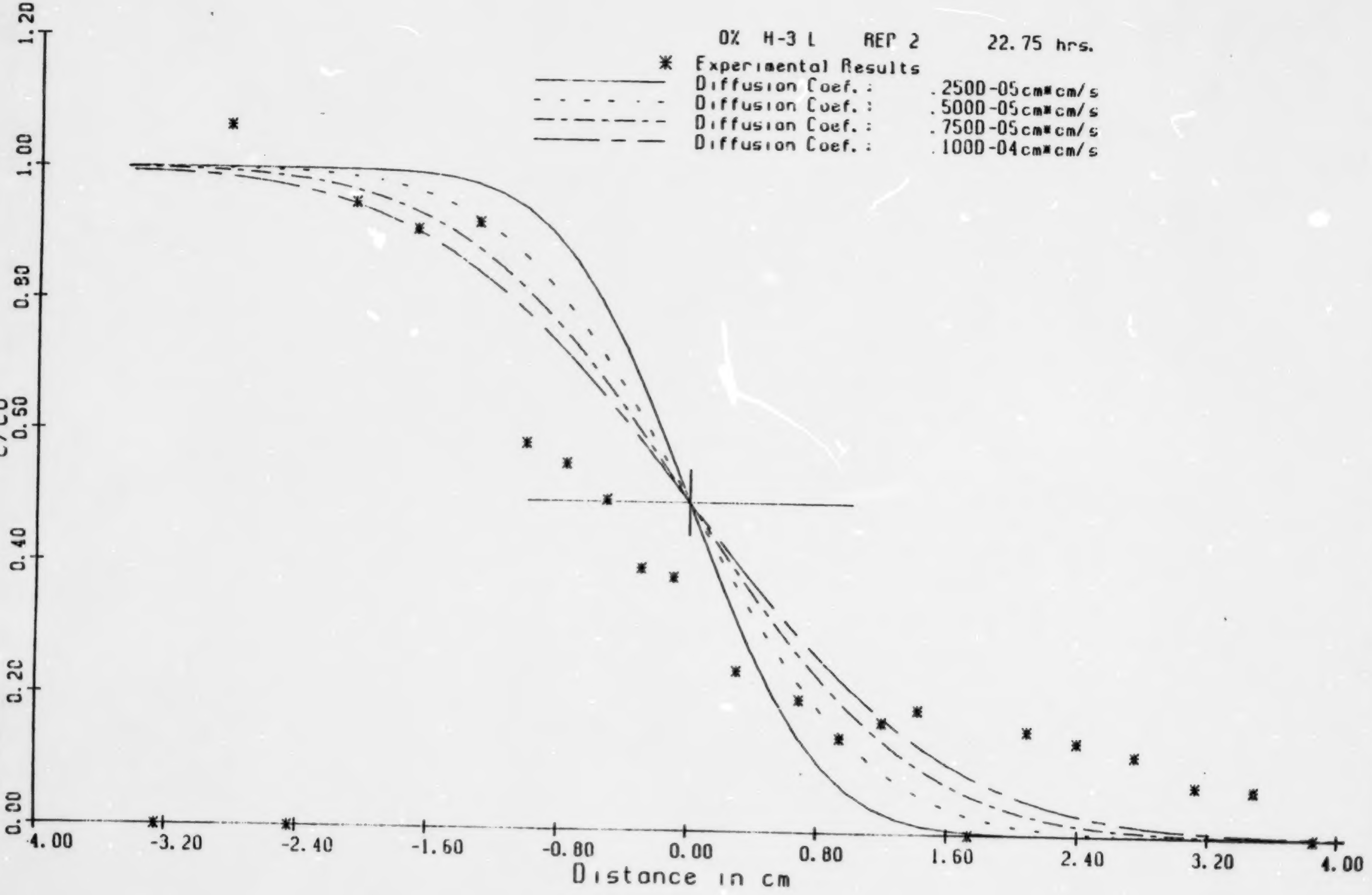

100% CL-36L REP 2 22.50 hrs.
* Experimental Results
Diffusion Coef.: 5000-05cm*cm/s
Diffusion Coef.: 1000-04cm*cm/s
Diffusion Coef.: 5000-04cm*cm/s
Diffusion Coef.: 1000-03cm*cm/s
C/CO
0.00
0.20
0.40
0.60
0.80
1.00
1.20
Distance in cm
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00

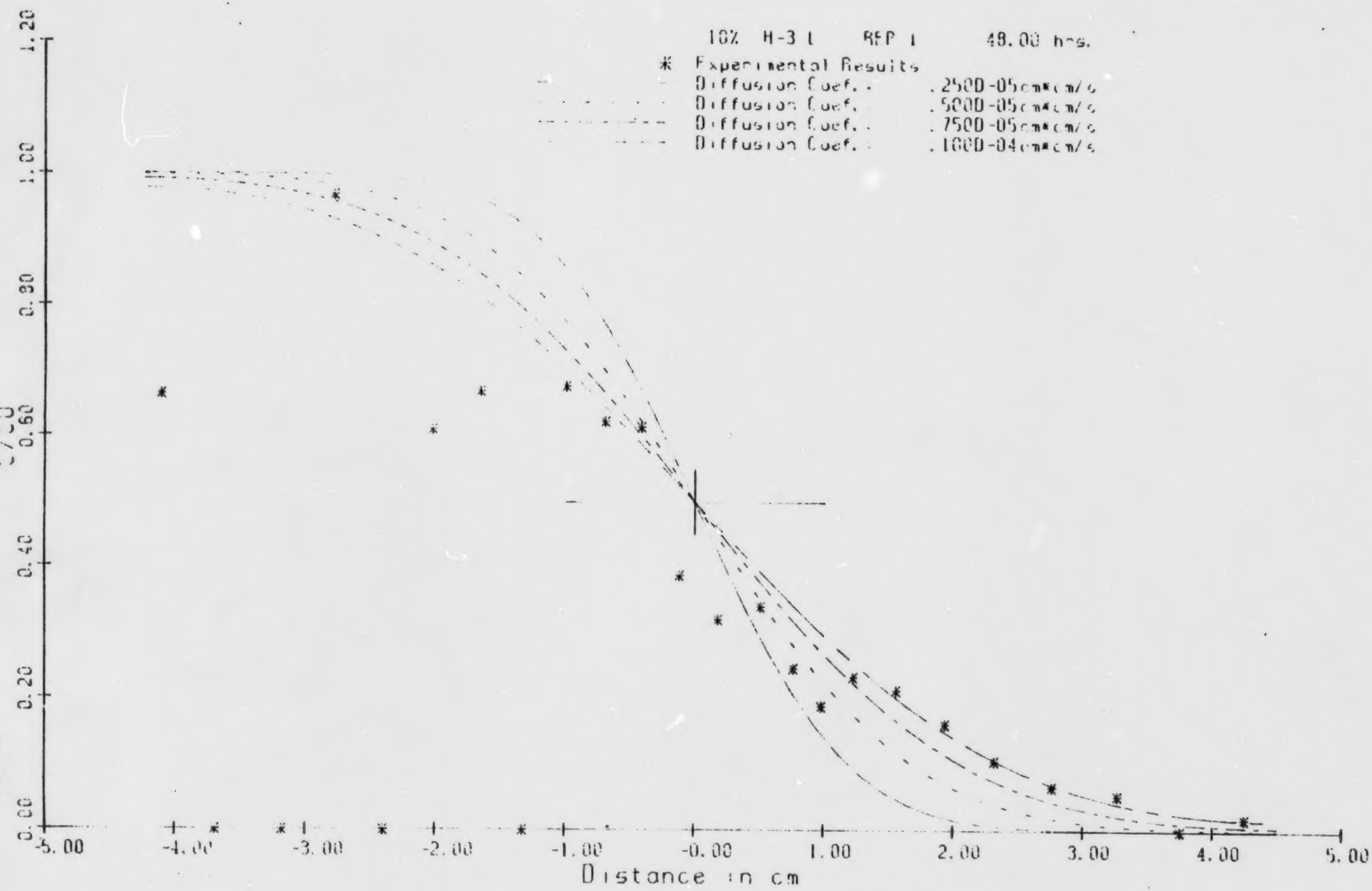
84-298

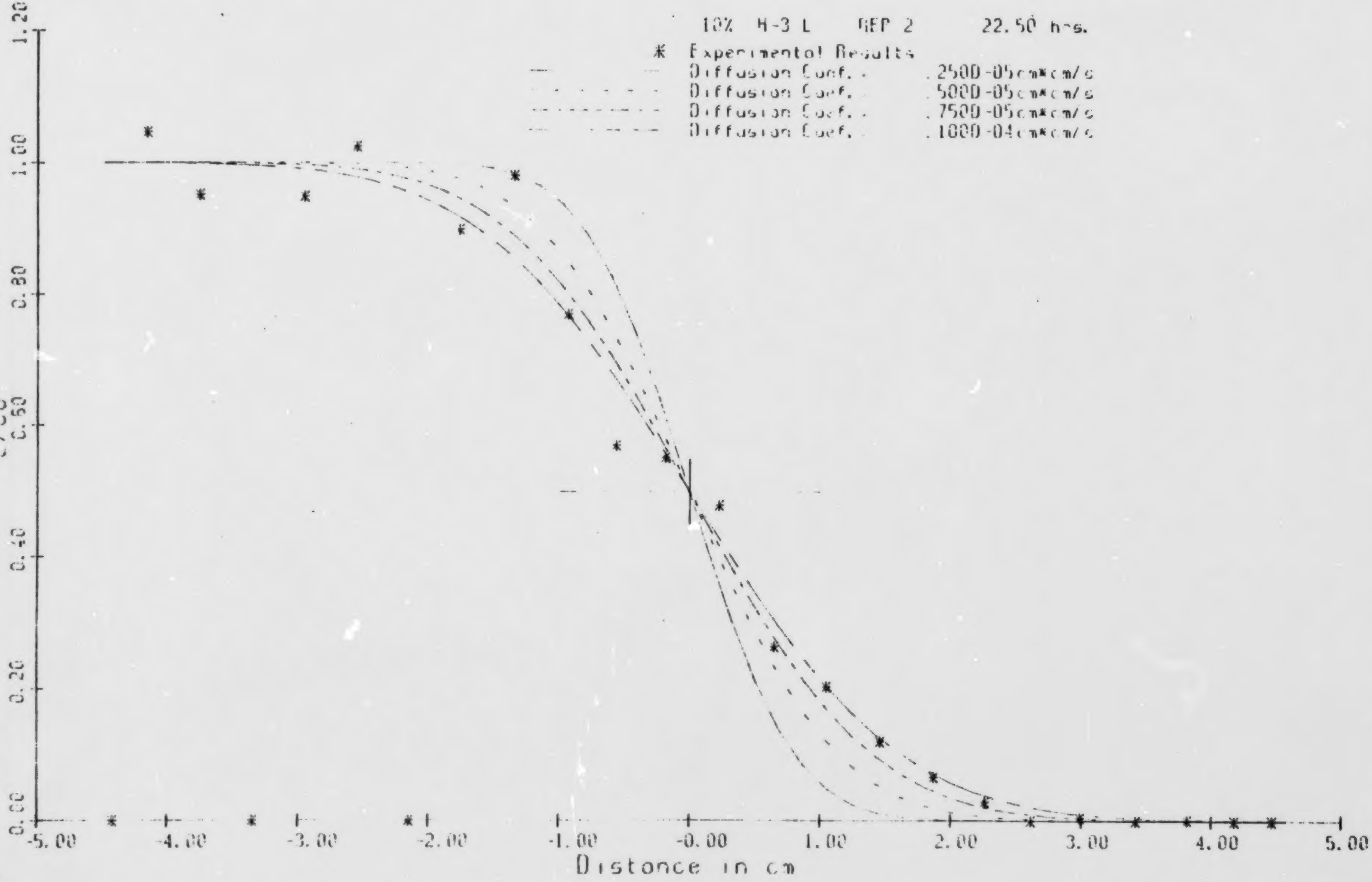

100% Cl-36H REP 1 43.50 hrs.
* Experimental Results
Diffusion Coef.: .5000-06cm*cm/s
Diffusion Coef.: .1000-05cm*cm/s
Diffusion Coef.: .2500-05cm*cm/s
Diffusion Coef.: .5000-05cm*cm/s
C/C0
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-3.00
-2.20
-1.40
-0.60
0.20
1.00
1.80
2.60
3.40
4.20
5.00
Distance in cm

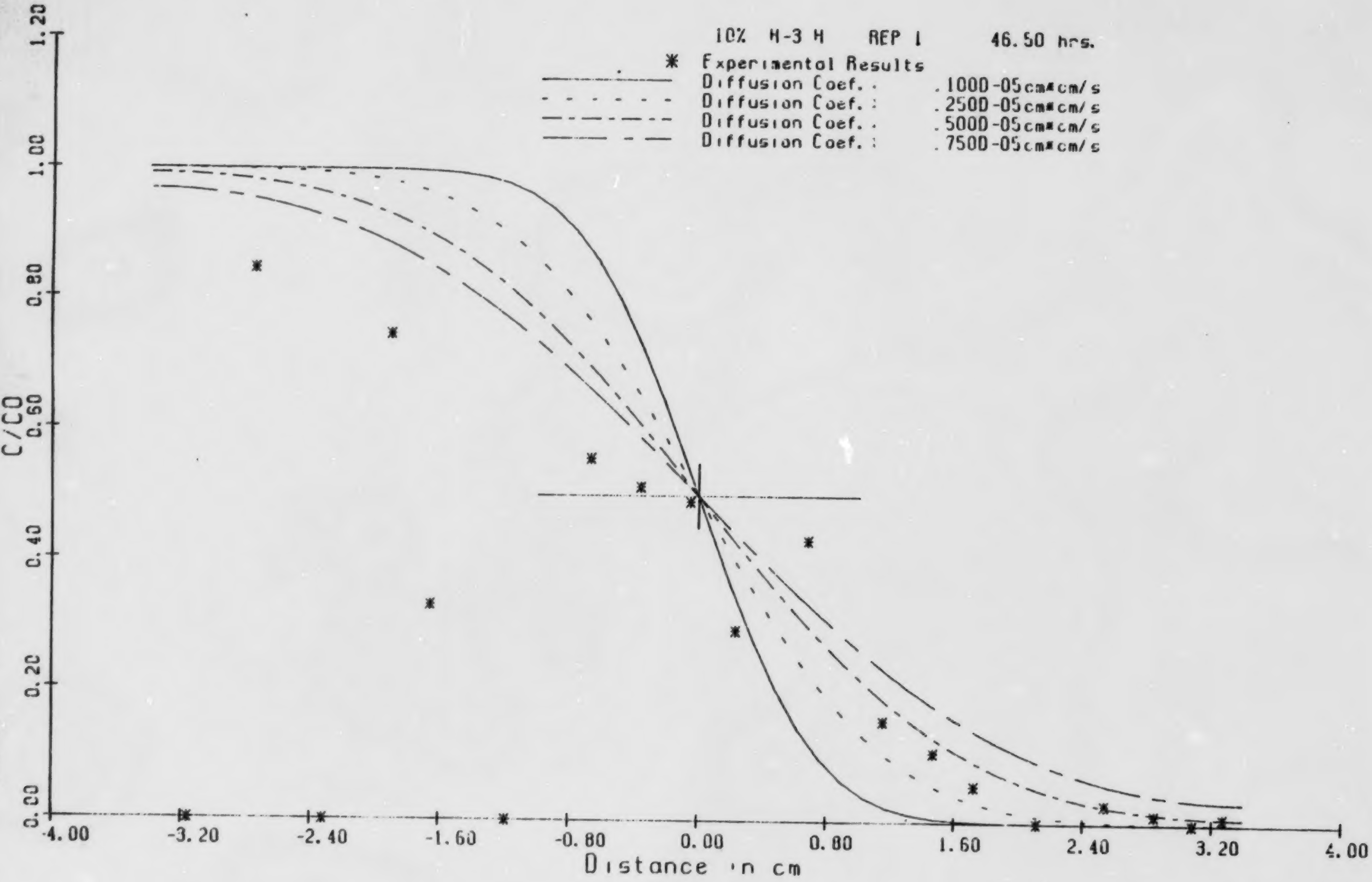

100% CL-3GH RFP 2 50.67 mns.
* Experimental Results
Diffusion Coef.: .5000-06cm*cm/s
Diffusion Coef.: .1000-05cm*cm/s
Diffusion Coef.: .2500-05cm*cm/s
Diffusion Coef.: .5000-05cm*cm/s
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-4.00
-3.20
-2.40
-1.60
-0.80
0.00
0.80
1.60
2.40
3.20
4.00
Distance in cm

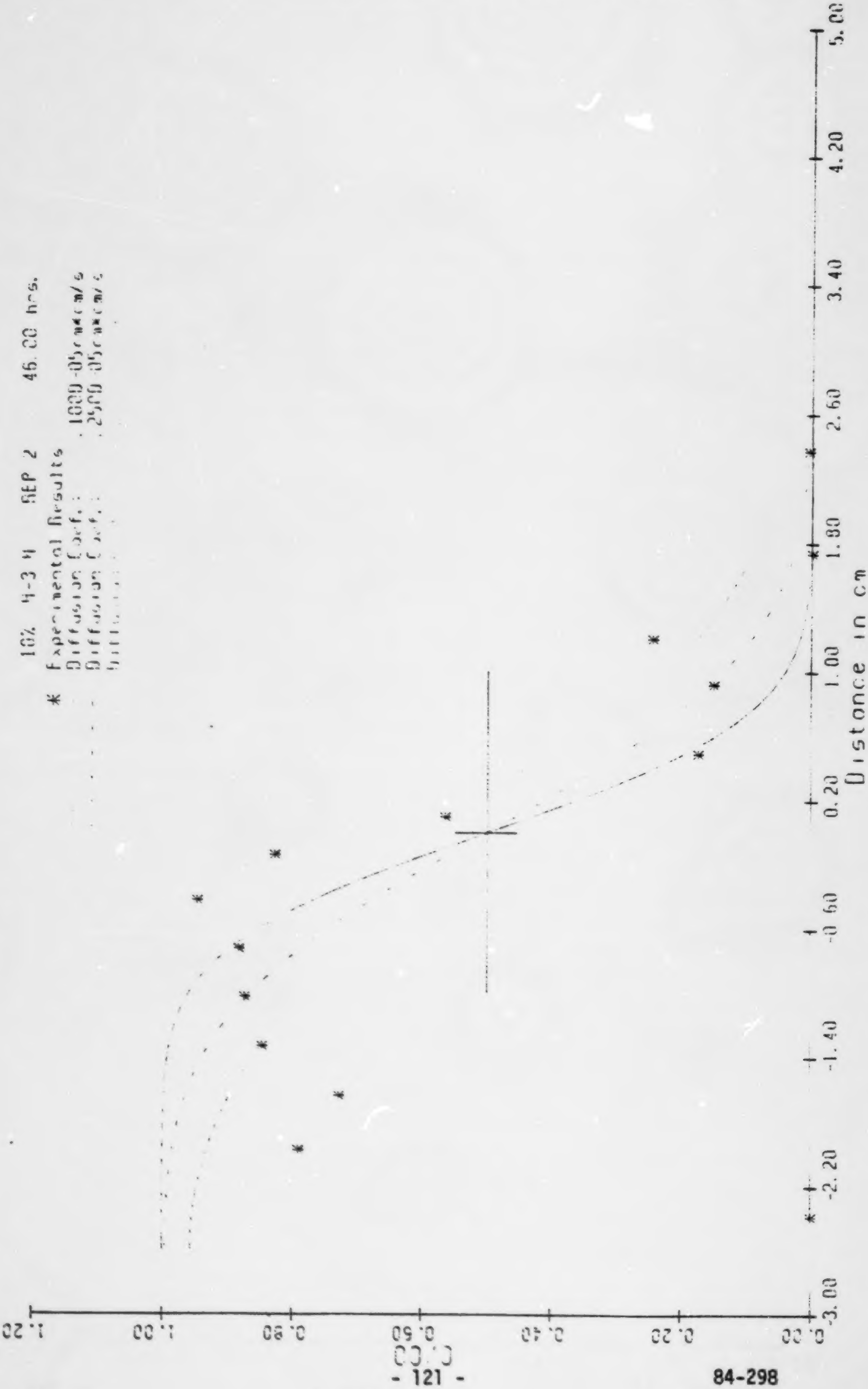

0% H-3 L   REP I   48.50 hrs.
* Experimental Results
Diffusion Coef. .2500-05cm*cm/s
Diffusion Coef. .5000-05cm*cm/s
Diffusion Coef. .7500-05cm*cm/s
Diffusion Coef. .1000-04cm*cm/s
C/Co
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

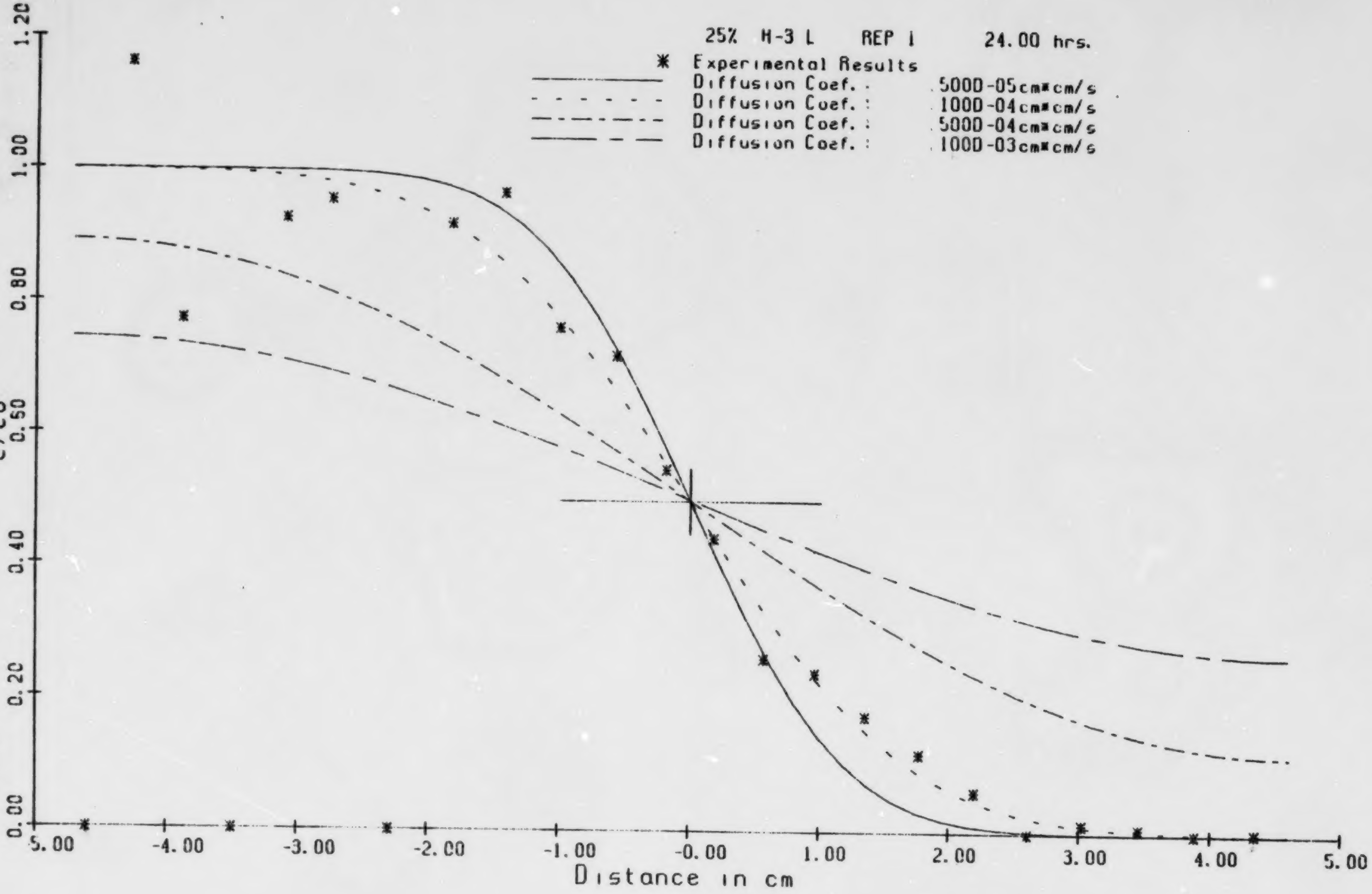

0% H-3 L REP 2 22.75 hrs.
✱ Experimental Results
Diffusion Coef. : .2500-05cm*cm/s
Diffusion Coef. : .5000-05cm*cm/s
Diffusion Coef. : .7500-05cm*cm/s
Diffusion Coef. : .1000-04cm*cm/s
C/C0
1.20
1.00
0.80
0.50
0.40
0.20
0.00
-4.00
-3.20
-2.40
-1.60
-0.80
0.00
0.80
1.60
2.40
3.20
4.00
Distance in cm

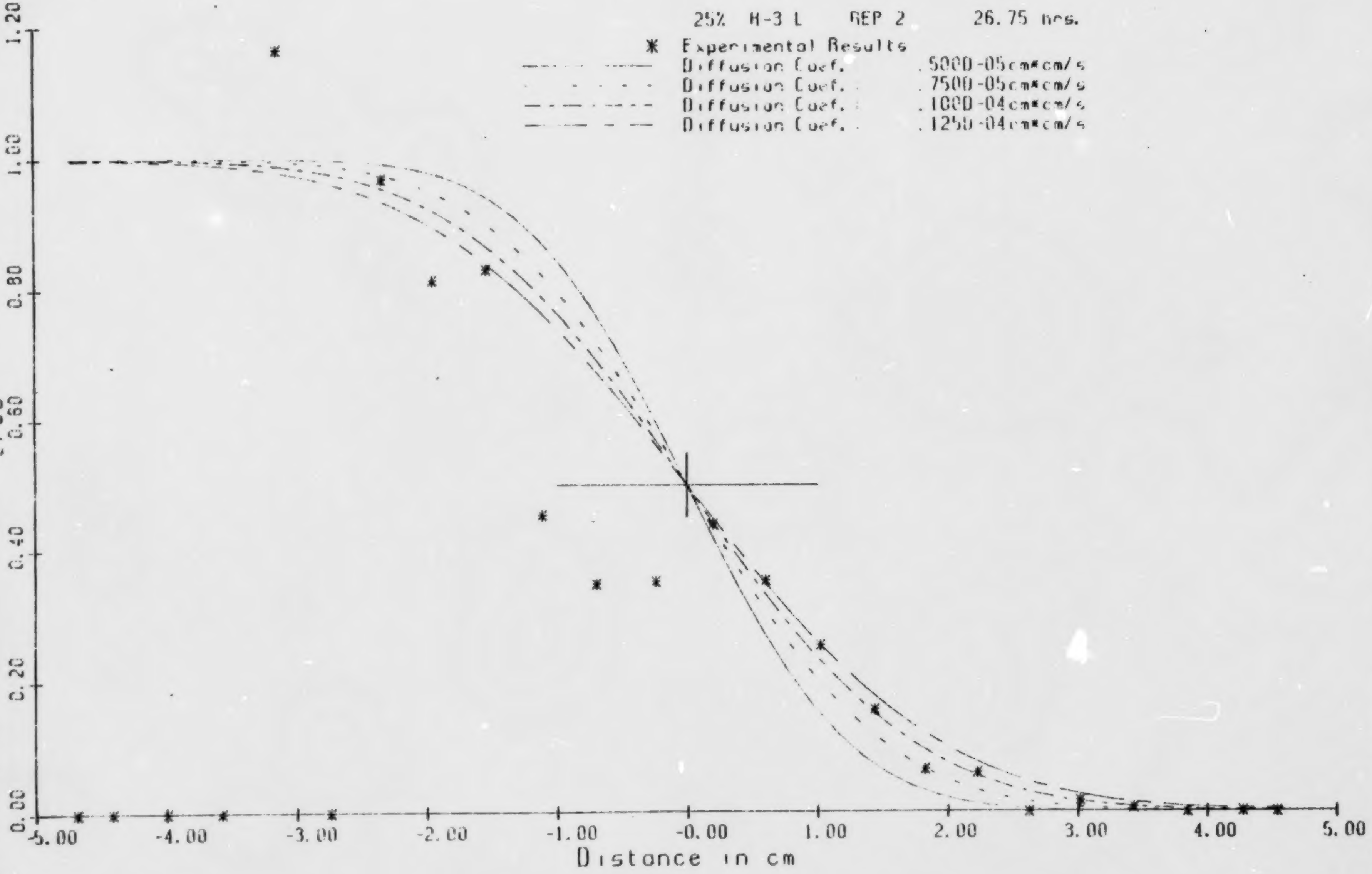

10% H-3 L REP 1 48.00 hrs.
* Experimental Results
Diffusion Coef. .2500-05cm*cm/s
Diffusion Coef. .5000-05cm*cm/s
Diffusion Coef. .7500-05cm*cm/s
Diffusion Coef. .1000-04cm*cm/s
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

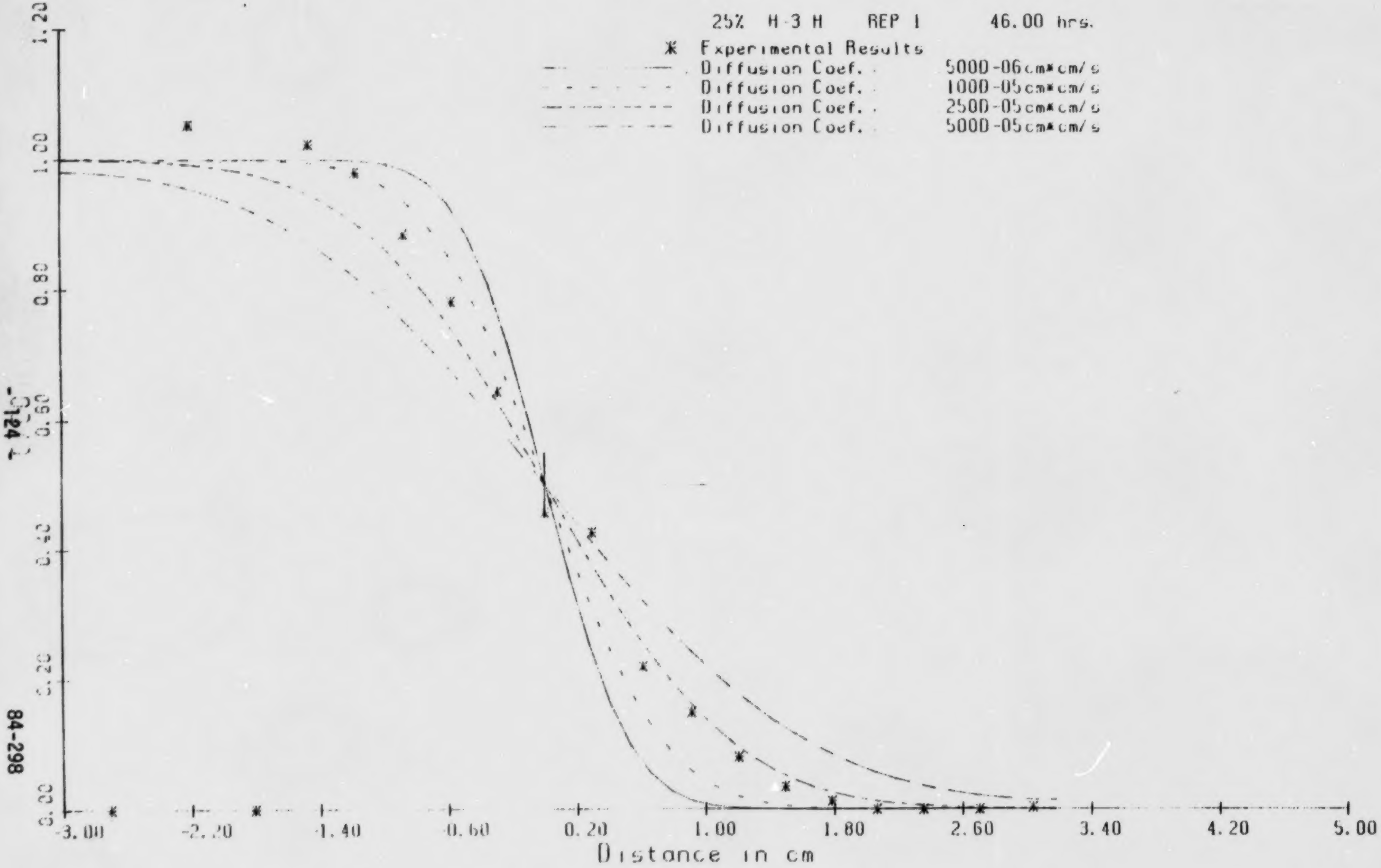

10% H-3 L REP 2 22.50 hrs.
* Experimental Results
Diffusion Coef. . .2500-05cm*cm/s
Diffusion Coef. . .5000-05cm*cm/s
Diffusion Coef. . .7500-05cm*cm/s
Diffusion Coef. . .1000-04cm*cm/s
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

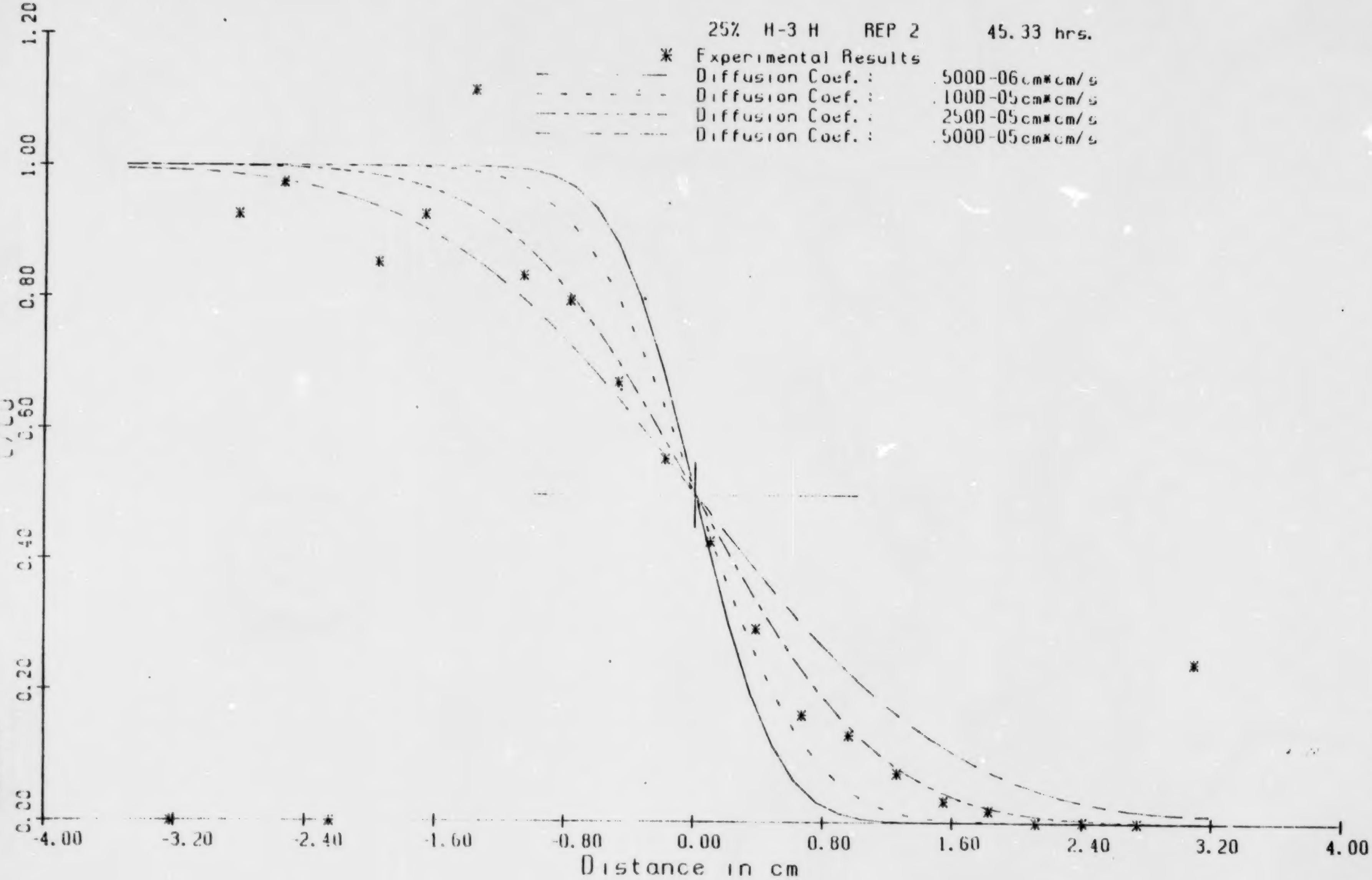

10% H-3 H REP I 46.50 hrs.
Experimental Results
Diffusion Coef. : .1000-05cm*cm/s
Diffusion Coef. : .2500-05cm*cm/s
Diffusion Coef. : .5000-05cm*cm/s
Diffusion Coef. : .7500-05cm*cm/s
C/CO
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-4.00
-3.20
-2.40
-1.60
-0.80
0.00
0.80
1.60
2.40
3.20
4.00
Distance in cm

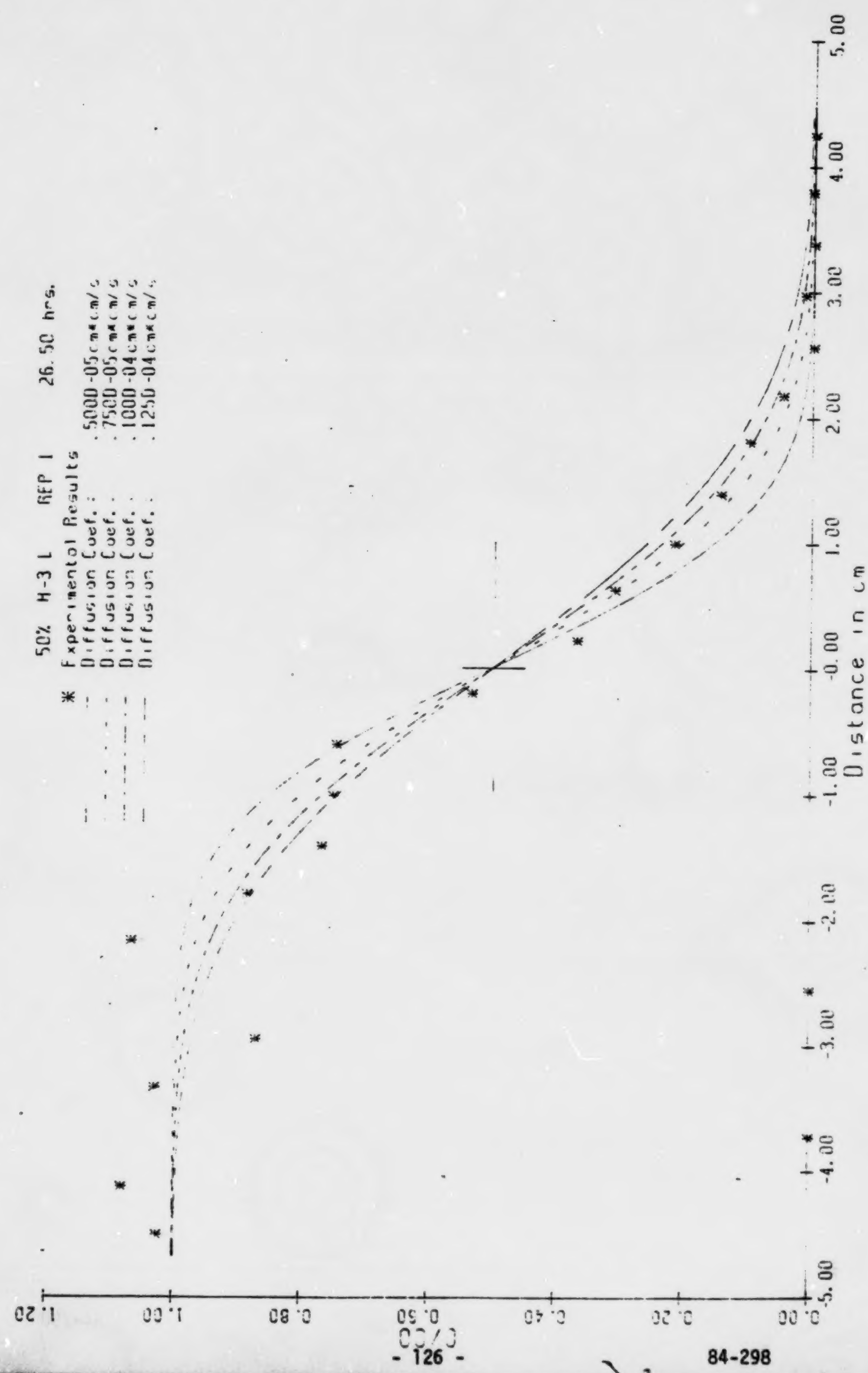
10% 4-3 N SEP 2 46.00 hrs.
* Experimental Results
Diffusion Coef.: .1000-05cm*cm/s
Diffusion Coef.: .2500-05cm*cm/s
C/CO
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-3.00
-2.20
-1.40
-0.60
0.20
1.00
1.80
2.60
3.40
4.20
5.00
Distance in cm

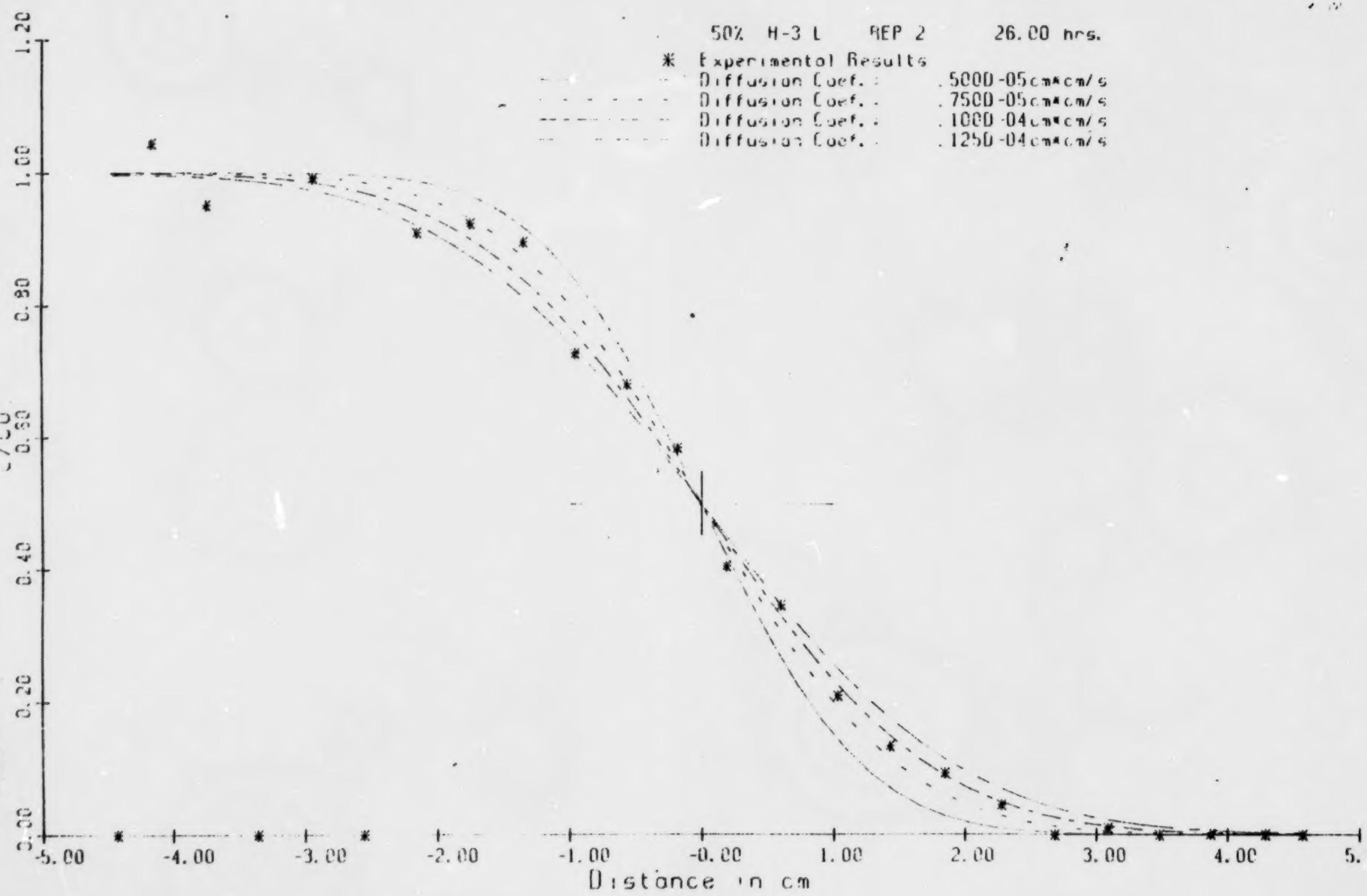

25% H-3 L REP 1 24.00 hrs.
* Experimental Results
Diffusion Coef. : .5000-05cm*cm/s
Diffusion Coef. : .1000-04cm*cm/s
Diffusion Coef. : .5000-04cm*cm/s
Diffusion Coef. : .1000-03cm*cm/s
C/C0
1.20
1.00
0.80
0.50
0.40
0.20
0.00
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

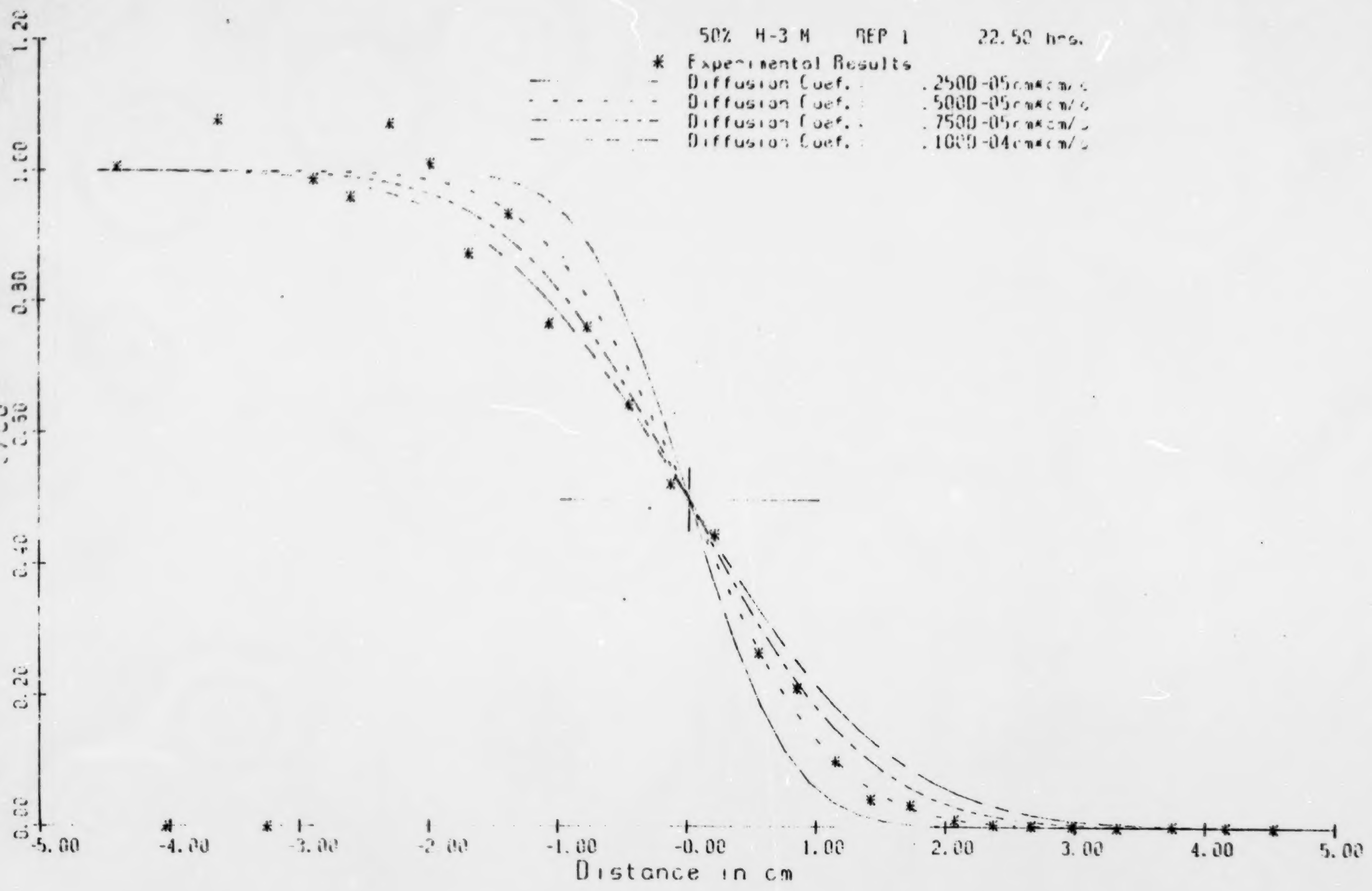

25% H-3 L REP 2 26.75 hrs.
Experimental Results
Diffusion Coef. .5000-05cm*cm/s
Diffusion Coef. .7500-05cm*cm/s
Diffusion Coef. .1000-04cm*cm/s
Diffusion Coef. .1250-04cm*cm/s
C/Co
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

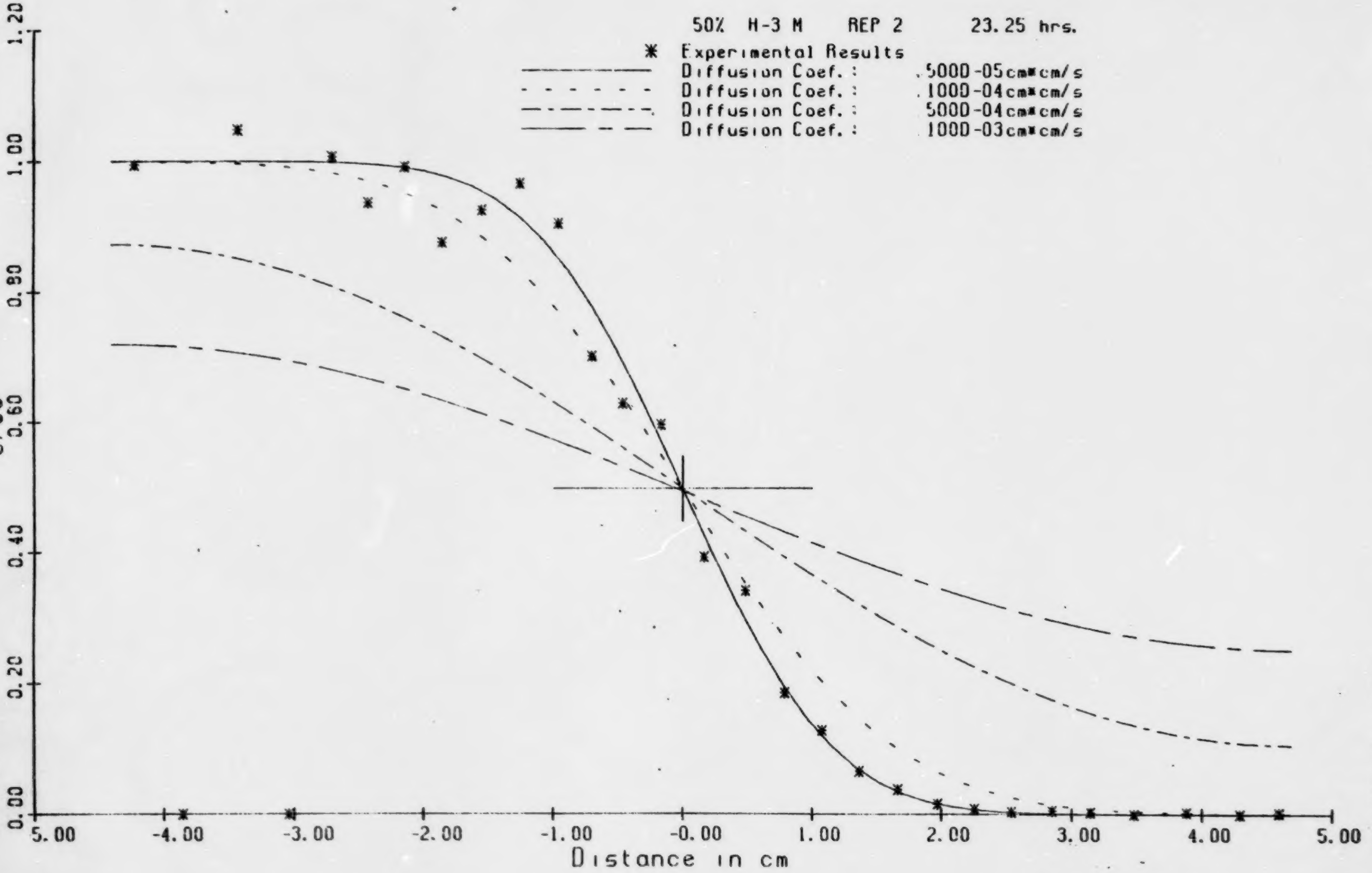

25% H-3 H REP 1 46.00 hrs.
Experimental Results
Diffusion Coef. 5000-06cm*cm/s
Diffusion Coef. 1000-05cm*cm/s
Diffusion Coef. 2500-05cm*cm/s
Diffusion Coef. 5000-05cm*cm/s
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-3.00
-2.20
-1.40
-0.60
0.20
1.00
1.80
2.60
3.40
4.20
5.00
Distance in cm

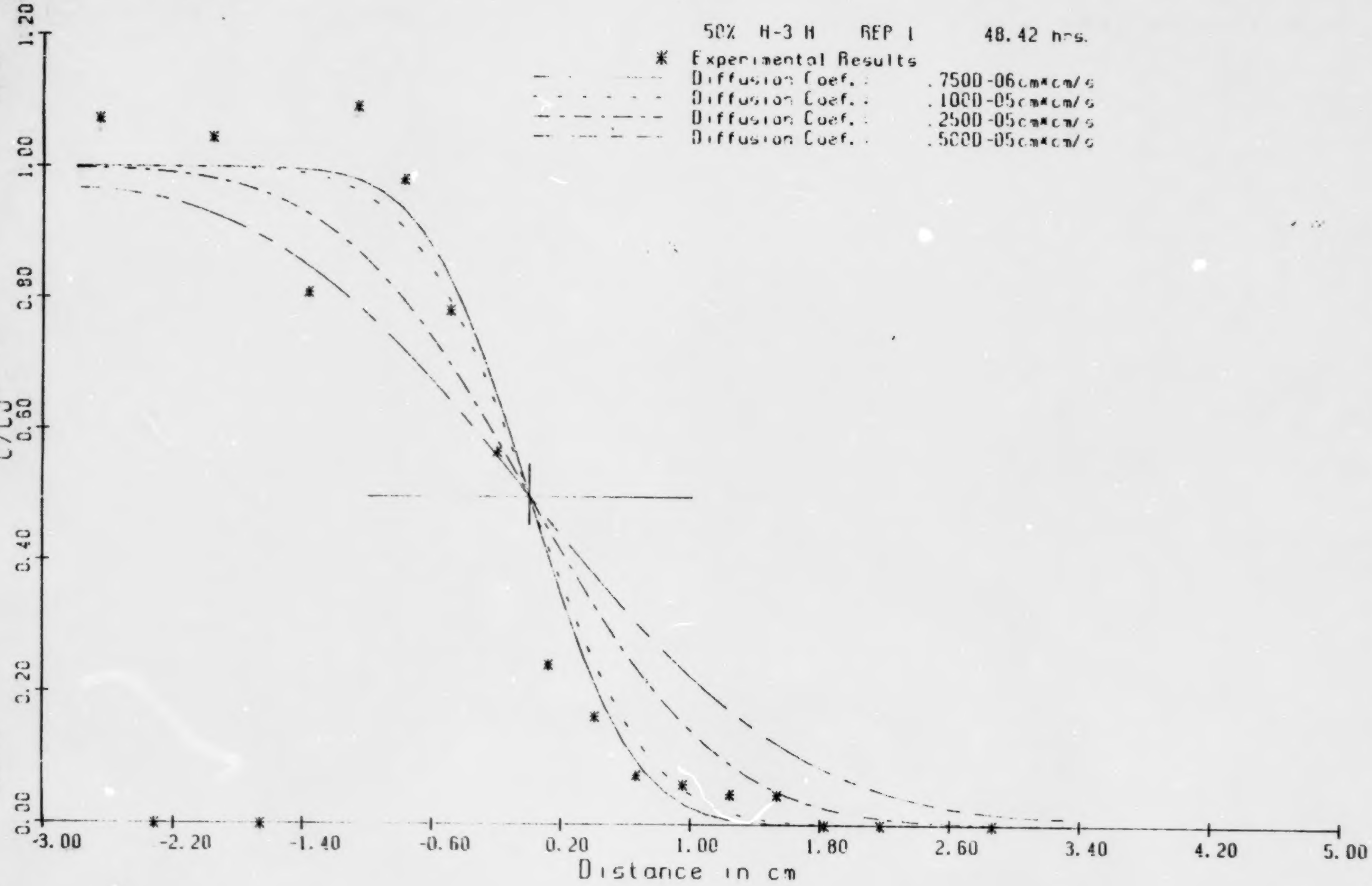

25% H-3 H REP 2 45.33 hrs.
Experimental Results
Diffusion Coef. : .5000-06cm*cm/s
Diffusion Coef. : .1000-05cm*cm/s
Diffusion Coef. : .2500-05cm*cm/s
Diffusion Coef. : .5000-05cm*cm/s
C/CO
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-4.00
-3.20
-2.40
-1.60
-0.80
0.00
0.80
1.60
2.40
3.20
4.00
Distance in cm

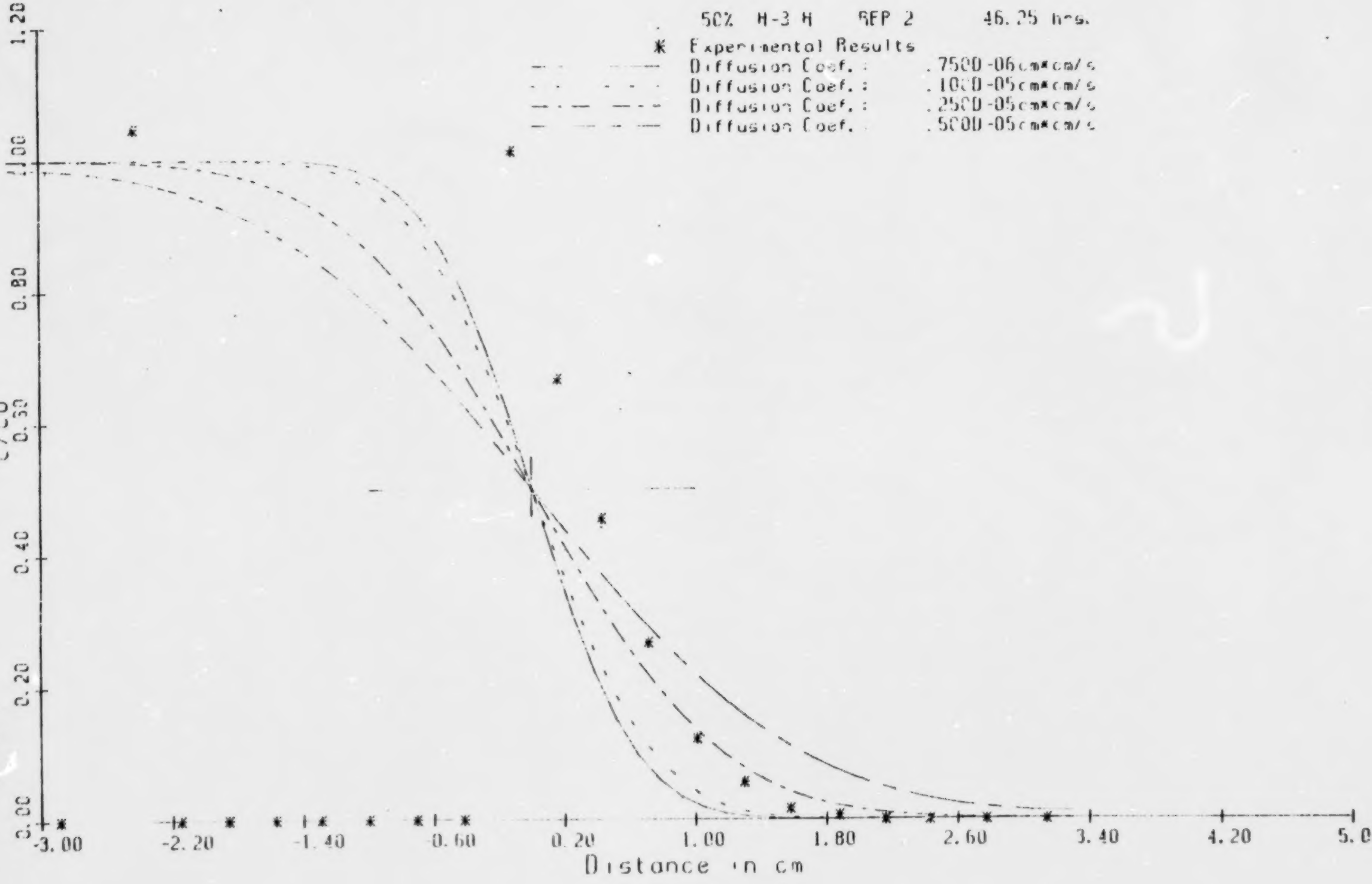

50% H-3 L REP I 26.50 hrs.
* Experimental Results
Diffusion Coef.: .500D-05cm*cm/s
Diffusion Coef.: .750D-05cm*cm/s
Diffusion Coef.: .100D-04cm*cm/s
Diffusion Coef.: .125D-04cm*cm/s
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

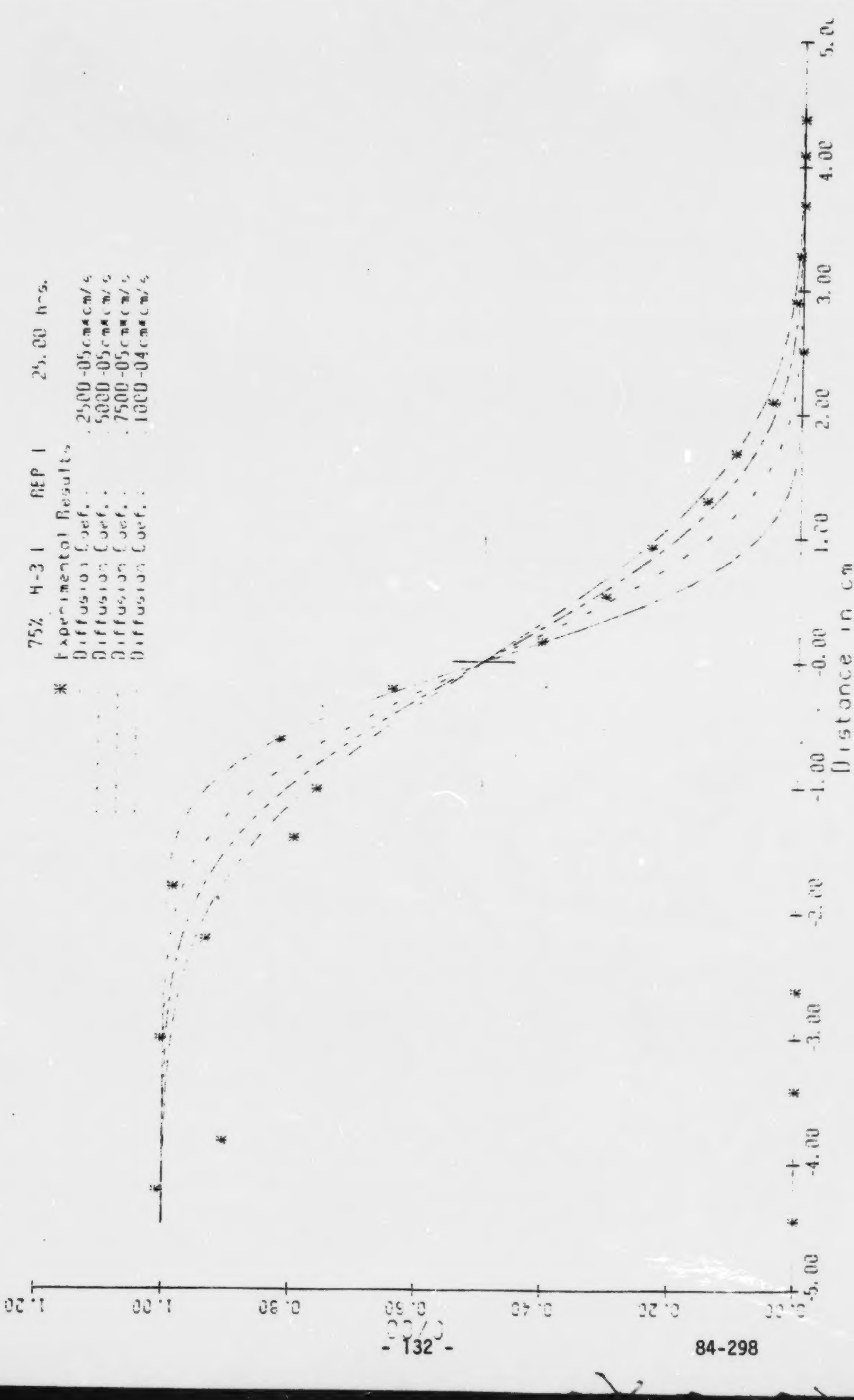
50% H-3 L REP 2 26.00 hrs.
* Experimental Results
Diffusion Coef. : .5000-05cm*cm/s
Diffusion Coef. : .7500-05cm*cm/s
Diffusion Coef. : .1000-04cm*cm/s
Diffusion Coef. : .1250-04cm*cm/s
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

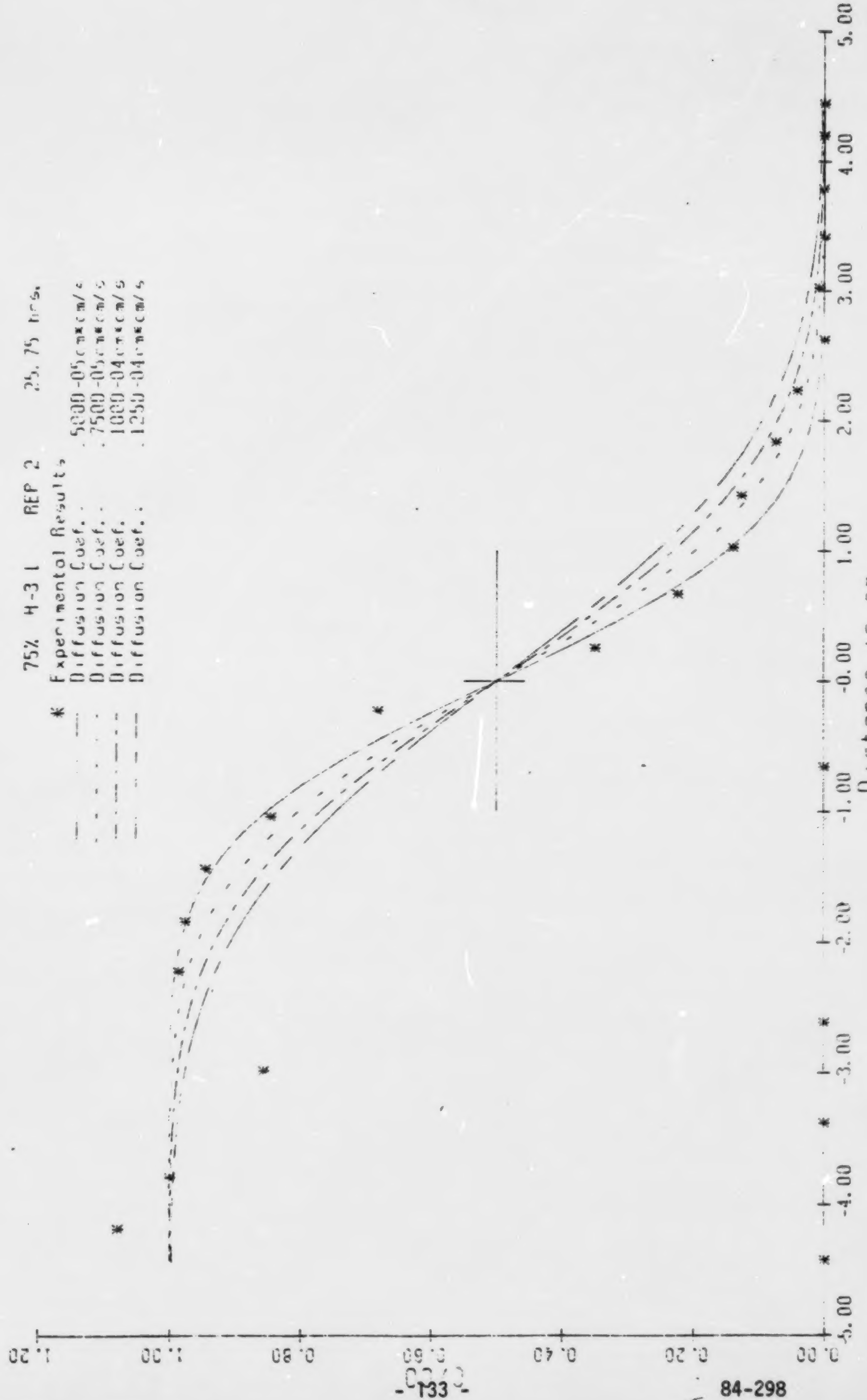

50% H-3 M REP 1 22.50 hrs.
Experimental Results
Diffusion Coef. .2500-05cm*cm/s
Diffusion Coef. .5000-05cm*cm/s
Diffusion Coef. .7500-05cm*cm/s
Diffusion Coef. .1000-04cm*cm/s
C/Co
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

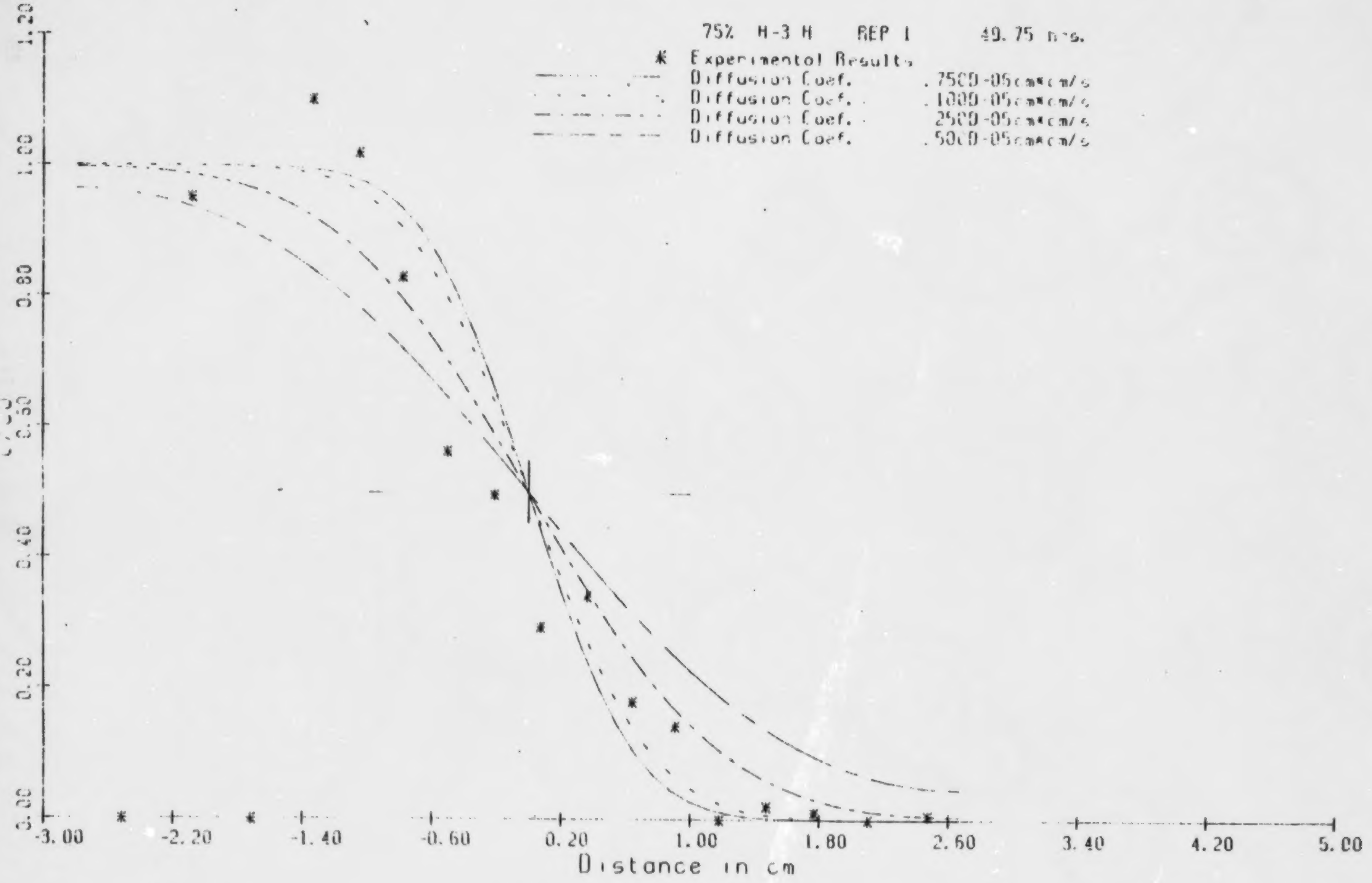
50% H-3 M REP 2 23.25 hrs.
Experimental Results
Diffusion Coef.: .5000-05cm*cm/s
Diffusion Coef.: .1000-04cm*cm/s
Diffusion Coef.: .5000-04cm*cm/s
Diffusion Coef.: .1000-03cm*cm/s
C/C0
1.20
1.00
0.80
0.60
0.40
0.20
0.00
5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

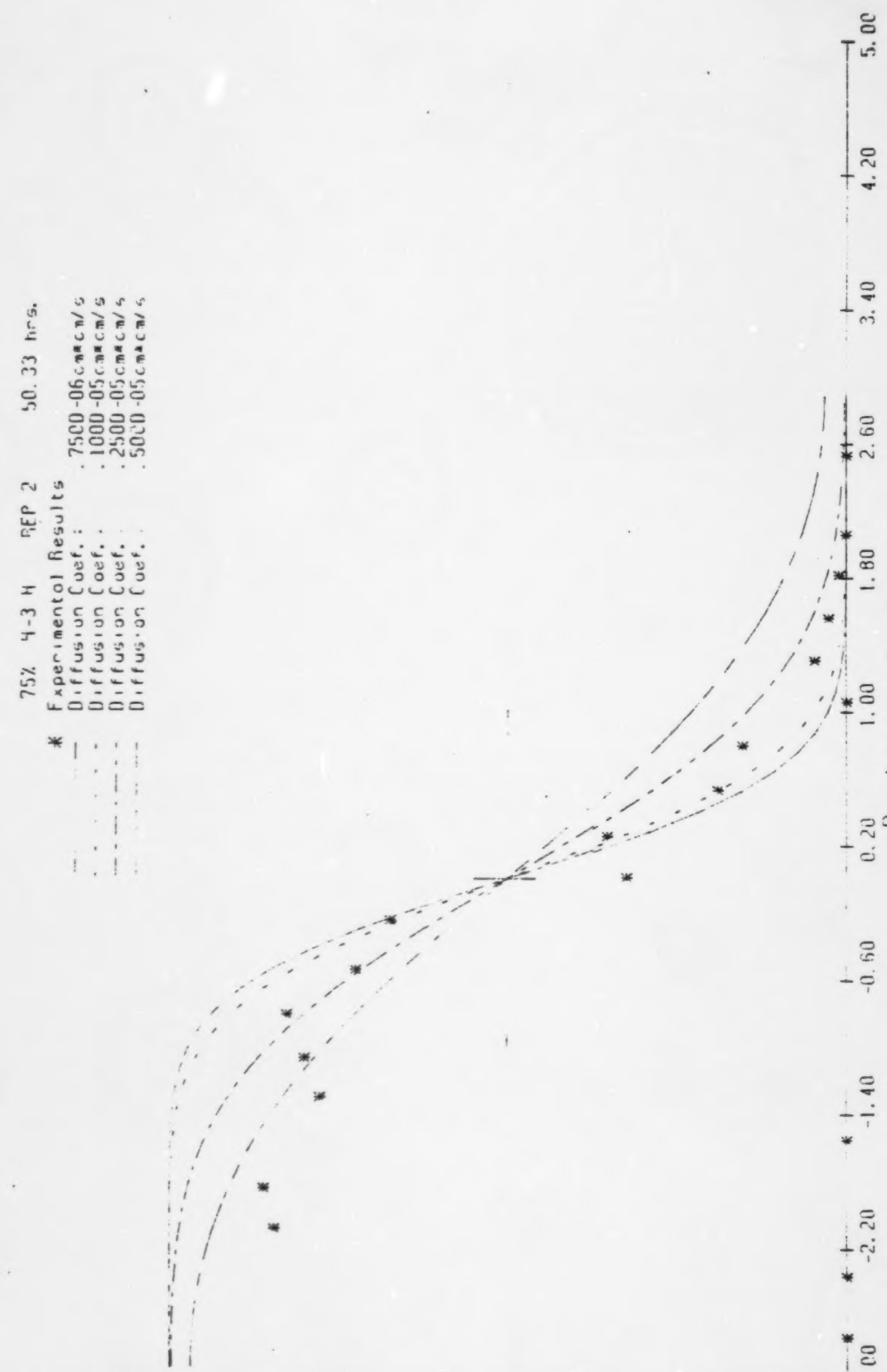

50% H-3 H REP 1 48.42 hrs.
Experimental Results
Diffusion Coef. : .7500-06cm*cm/s
Diffusion Coef. : .1000-05cm*cm/s
Diffusion Coef. : .2500-05cm*cm/s
Diffusion Coef. : .5000-05cm*cm/s
C/CO
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-3.00
-2.20
-1.40
-0.60
0.20
1.00
1.80
2.60
3.40
4.20
5.00
Distance in cm

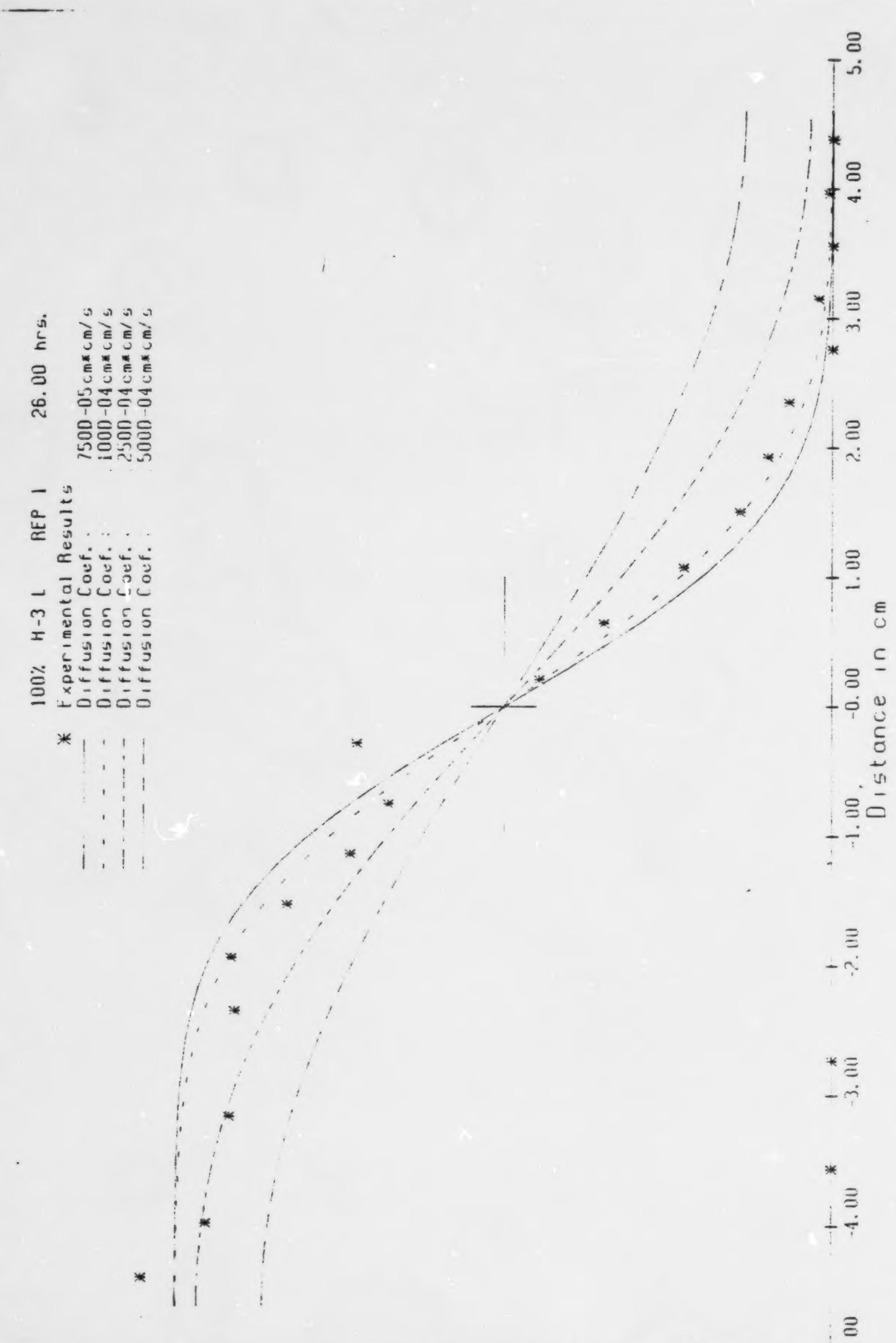
50% H-3 H REP 2 46.25 hrs.
✱ Experimental Results
Diffusion Coef. : .7500-06cm*cm/s
Diffusion Coef. : .1000-05cm*cm/s
Diffusion Coef. : .2500-05cm*cm/s
Diffusion Coef. : .5000-05cm*cm/s
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-3.00
-2.20
-1.40
-0.60
0.20
1.00
1.80
2.60
3.40
4.20
5.00
Distance in cm

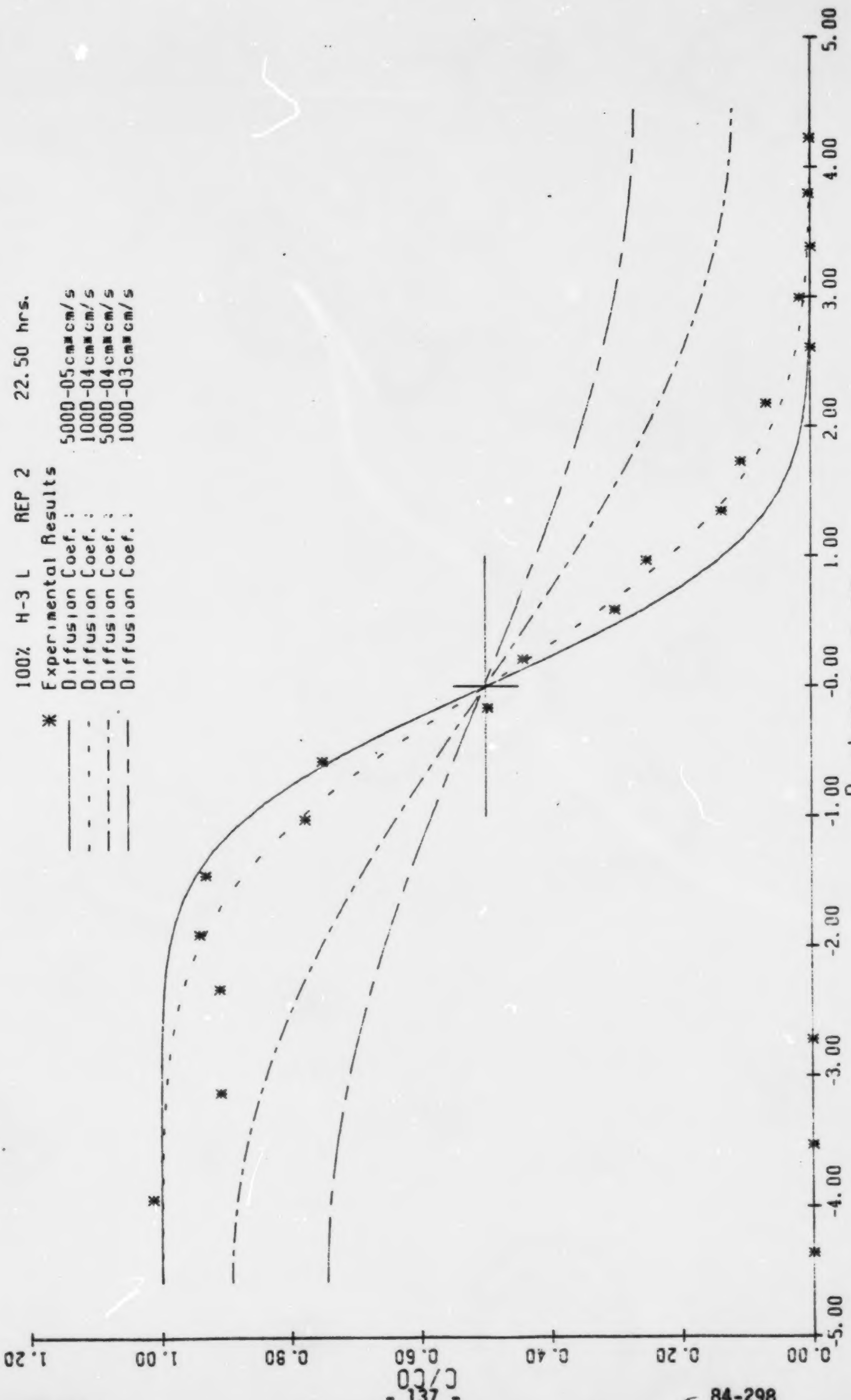

75% H-3 I REP I 25.00 hrs.
* Experimental Results
Diffusion Coef. : .2500-05cm*cm/s
Diffusion Coef. : .5000-05cm*cm/s
Diffusion Coef. : .7500-05cm*cm/s
Diffusion Coef. : .1000-04cm*cm/s
Distance in cm
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20

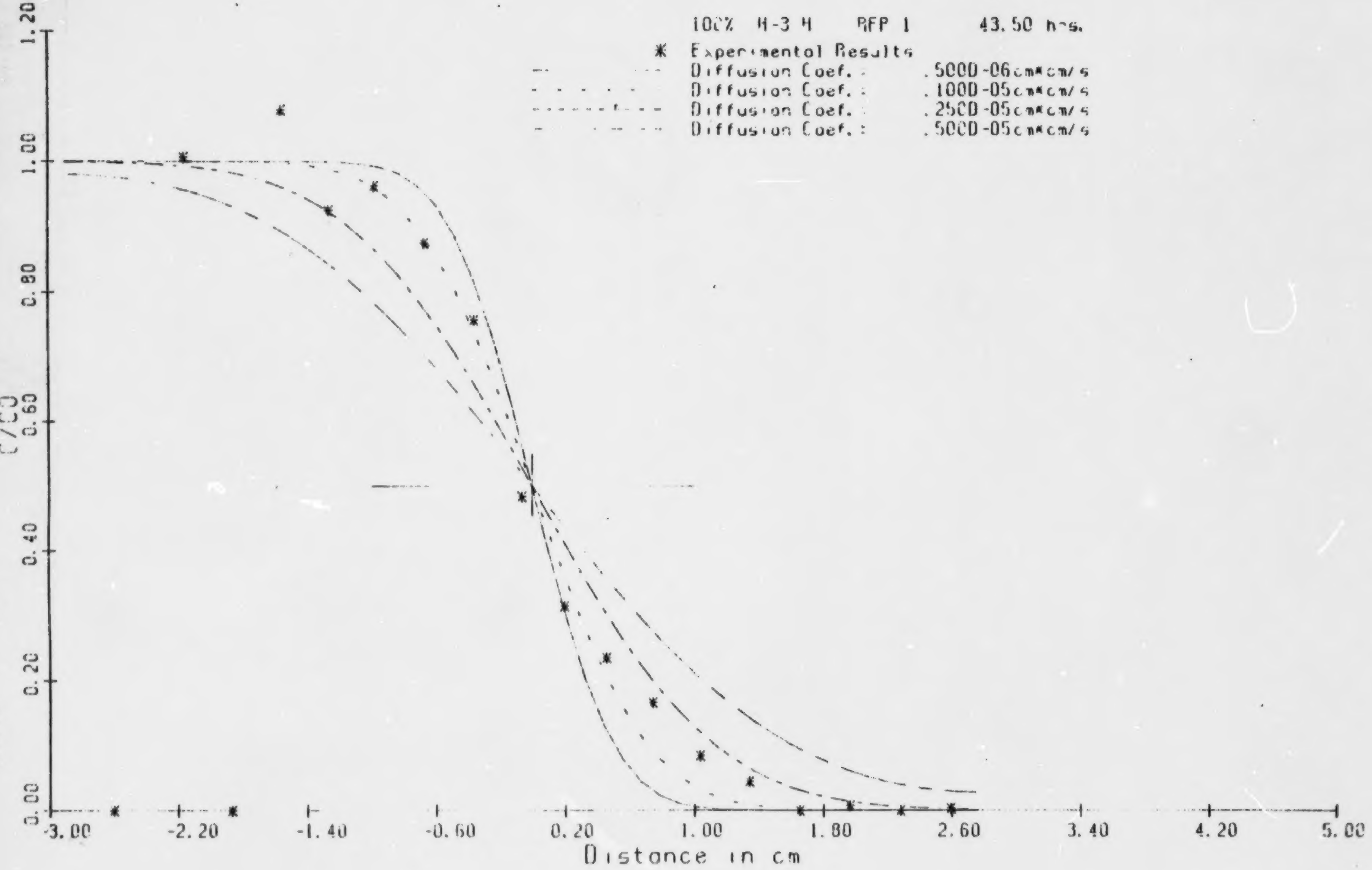

75% H-3 I REP 2 25.75 hrs.
* Experimental Results
Diffusion Coef. .5000-05cm*cm/s
Diffusion Coef. .7500-05cm*cm/s
Diffusion Coef. .1000-04cm*cm/s
Diffusion Coef. .1250-04cm*cm/s
Distance in cm
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20

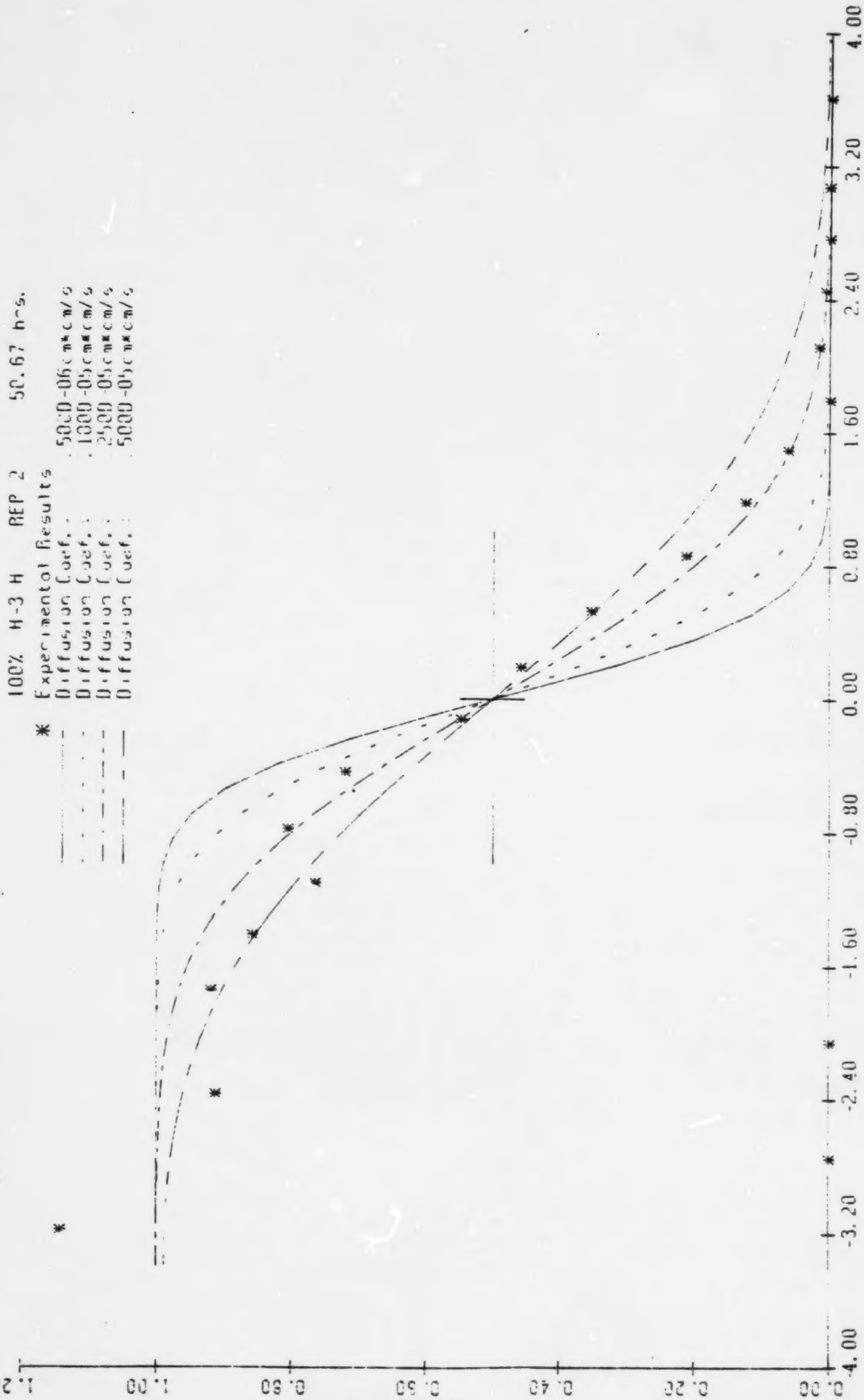

75% H-3 H REP I 49.75 n-s.
* Experimentol Results
Diffusion Coef. .7500-05cm*cm/s
Diffusion Coef. .1000-05cm*cm/s
Diffusion Coef. 2500-05cm*cm/s
Diffusion Coef. .5000-05cm*cm/s
C/CO
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-3.00
-2.20
-1.40
-0.60
0.20
1.00
1.80
2.60
3.40
4.20
5.00
Distance in cm


75% 4-3 H REP 2 50.33 hrs.
* Experimental Results
Diffusion Coef.: .7500-06cm*cm/s
Diffusion Coef.: .1000-05cm*cm/s
Diffusion Coef.: .2500-05cm*cm/s
Diffusion Coef.: .5000-05cm*cm/s
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
Distance in cm
-3.00
-2.20
-1.40
-0.60
0.20
1.00
1.80
2.60
3.40
4.20
5.00


100% H-3 L REP 1 26.00 hrs.
* Experimental Results
Diffusion Coef. 7500D-05cm*cm/s
Diffusion Coef. 1000D-04cm*cm/s
Diffusion Coef. 2500D-04cm*cm/s
Diffusion Coef. 5000D-04cm*cm/s
Distance in cm
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
0.00
0.20
0.40
0.60
0.80
1.00
1.20


100% H-3 L REP 2 22.50 hrs.
* Experimental Results
Diffusion Coef.: 5000-05cm*cm/s
Diffusion Coef.: 1000-04cm*cm/s
Diffusion Coef.: 5000-04cm*cm/s
Diffusion Coef.: 1000-03cm*cm/s
C/CO
0.00
0.20
0.40
0.60
0.80
1.00
1.20
Distance in cm
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00


100% H-3 H RFP 1 43.50 hrs.
Experimental Results
Diffusion Coef. : .5000-06cm*cm/s
Diffusion Coef. : .1000-05cm*cm/s
Diffusion Coef. : .2500-05cm*cm/s
Diffusion Coef. : .5000-05cm*cm/s
C/C0
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-3.00
-2.20
-1.40
-0.60
0.20
1.00
1.80
2.60
3.40
4.20
5.00
Distance in cm


100% H-3 H REP 2 50.67 hrs.
* Experimental Results
Diffusion Coef. : .5000-06cm*cm/s
Diffusion Coef. : .1000-05cm*cm/s
Diffusion Coef. : .2500-05cm*cm/s
Diffusion Coef. : .5000-05cm*cm/s
Distance in cm
C/C0
-4.00
-3.20
-2.40
-1.60
-0.80
0.00
0.80
1.60
2.40
3.20
4.00
0.00
0.20
0.40
0.60
0.80
1.00
1.20

Appendix C

STRONTIUM DIFFUSION DATA

Note:

Appendix C1: Ontario Hydro Results

Appendix C2: University of Waterloo Results

Appendix C1

ONTARIO HYDRO RESULTS

0% BENTONITE

Low Bulk Density

Water Content

X (cm)	C / CO	Bulk Density (g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.95	0.974340	1.9593	0.0870	0.1704	0.2606	0.6539
-4.65	0.895834	1.9617	0.0832	0.1632	0.2597	0.6283
-4.35	0.908988	2.1098	0.0836	0.1765	0.2038	0.8657
-4.05	0.903488	2.0331	0.0859	0.1747	0.2328	0.7502
-3.75	0.968556	2.0252	0.0892	0.1807	0.2358	0.7664
-3.45	0.971202	2.0451	0.0919	0.1879	0.2282	0.8234
-3.15	0.990205	2.0627	0.0911	0.1880	0.2216	0.8481
-2.85	0.952126	1.9617	0.0937	0.1837	0.2597	0.7074
-2.55	1.004570	2.0548	0.0953	0.1958	0.2246	0.8718
-2.25	1.016653	1.9714	0.0935	0.1843	0.2561	0.7198
-1.95	1.066768	2.0095	0.0980	0.1970	0.2417	0.8151
-1.65	1.112453	2.0397	0.0996	0.2031	0.2303	0.8817
-1.35	1.083218	1.9049	0.0999	0.1904	0.2812	0.6771
-1.05	1.096510	1.9629	0.1010	0.1982	0.2593	0.7646
-0.75	1.031858	1.8971	0.1019	0.1934	0.2841	0.6807
-0.45	0.833839	1.9182	0.1172	0.2248	0.2761	0.8141
-0.15	0.727406	2.1189	0.1075	0.2278	0.2004	1.1368
0.15	0.290441	1.8856	0.1119	0.2109	0.2885	0.7312
0.45	0.110443	1.8935	0.0999	0.1892	0.2855	0.6626
0.75	0.047170	1.9756	0.0970	0.1916	0.2545	0.7529
1.05	0.020945	1.9563	0.0973	0.1904	0.2618	0.7272
1.35	0.014166	1.9225	0.0984	0.1892	0.2745	0.6890
1.65	0.003681	1.9684	0.0986	0.1940	0.2572	0.7542
1.95	0.001701	2.0560	0.0976	0.2006	0.2241	0.8952
2.25	0.001484	2.0198	0.0963	0.1946	0.2378	0.8182
2.55	0.002966	2.0216	0.0939	0.1898	0.2371	0.8002
2.85	0.001082	2.0790	0.0907	0.1886	0.2155	0.8751
3.15	0.001764	2.1249	0.0887	0.1886	0.1981	0.9517
3.45	0.001633	1.9889	0.0863	0.1716	0.2495	0.6881
3.75	0.000838	2.0868	0.0831	0.1735	0.2125	0.8162
4.05	0.001328	2.0693	0.0847	0.1753	0.2191	0.7998
4.35	0.002098	2.0246	0.0809	0.1638	0.2360	0.6940
4.65	0.001414	1.9436	0.0824	0.1602	0.2666	0.6008
4.95	0.001613	1.8590	0.0875	0.1626	0.2985	0.5446

Rep. 1, Time: 151200 s, CO: 2418 cpm/g
Average Bulk Density................1.9974 g/cc
Average Gravimetric Water Content...0.0940 g/g
Average Volumetric Water Content....0.1875 cc/cc
Average Porosity....................0.2463 cc/cc
Average Saturation..................0.7708 cc/cc

0% BENTONITE

Low Bulk Density

			Water Content			
X (cm)	C / C0	Bulk Density (g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.95	0.907226	2.0101	0.0908	0.1825	0.2415	0.7558
-4.65	0.957508	2.1503	0.0866	0.1862	0.1886	0.9872
-4.35	0.919738	1.9702	0.0834	0.1644	0.2565	0.6408
-4.05	0.961026	2.0560	0.0844	0.1735	0.2241	0.7738
-3.75	0.925573	1.9732	0.0864	0.1704	0.2554	0.6673
-3.45	0.981170	2.1739	0.0904	0.1964	0.1797	1.0932
-3.15	0.952383	2.0331	0.0871	0.1771	0.2328	0.7606
-2.85	0.994300	1.9188	0.0894	0.1716	0.2759	0.6221
-2.55	1.022758	2.1134	0.0935	0.1976	0.2025	0.9760
-2.25	1.088883	2.0077	0.0945	0.1898	0.2424	0.7829
-1.95	1.070655	2.0294	0.0953	0.1934	0.2342	0.8258
-1.65	1.081820	1.9194	0.0967	0.1855	0.2757	0.6730
-1.35	1.063732	2.0198	0.0960	0.1940	0.2378	0.8157
-1.05	0.974639	2.0324	0.0957	0.1946	0.2330	0.8351
-0.75	0.789014	1.8022	0.0993	0.1789	0.3199	0.5591
-0.45	0.739980	1.8487	0.1036	0.1916	0.3024	0.6336
-0.15	0.635339	1.4251	0.1077	0.1535	0.4622	0.3321
0.15	0.410749	2.1860	0.1106	0.2417	0.1751	1.3805
0.45	0.190983	1.8167	0.0991	0.1801	0.3145	0.5727
0.75	0.095665	1.7937	0.0923	0.1656	0.3231	0.5125
1.05	0.039063	1.9267	0.0828	0.1595	0.2729	0.5845
1.35	0.019614	1.7907	0.0918	0.1644	0.3243	0.5070
1.65	0.006688	1.6505	0.0934	0.1541	0.3772	0.4086
1.95	0.004426	1.8705	0.0885	0.1656	0.2942	0.5629
2.25	0.001552	2.1013	0.0909	0.1910	0.2070	0.9224
2.55	0.001607	1.8729	0.0836	0.1565	0.2932	0.5338
2.85	0.001275	1.9684	0.0838	0.1650	0.2572	0.6415
3.15	0.001589	2.0524	0.0839	0.1722	0.2255	0.7638
3.45	0.001615	2.0198	0.0850	0.1716	0.2378	0.7217
3.75	0.001641	1.9871	0.0861	0.1710	0.2501	0.6838
4.05	0.002213	2.0409	0.0844	0.1722	0.2298	0.7494
4.35	0.002346	1.9249	0.0841	0.1620	0.2736	0.5919
4.65	0.002058	2.0723	0.0834	0.1728	0.2180	0.7929
4.95	0.005480	1.8312	0.0805	0.1475	0.3090	0.4773

Rep. 2, Time: 151200 s, C0: 2409 cpm/g
Average Bulk Density................1.9526 g/cc
Average Gravimetric Water Content...0.0907 g/g
Average Volumetric Water Content....0.1769 cc/cc
Average Porosity....................0.2632 cc/cc
Average Saturation..................0.7100 cc/cc

0% BENTONITE

Low Bulk Density

			Water Content			
X (cm)	C / C0	Bulk Density (g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.95	0.936863	2.2748	0.0696	0.1583	0.1416	1.1184
-4.65	0.894153	1.9454	0.0659	0.1281	0.2659	0.4819
-4.35	0.896852	2.0627	0.0665	0.1372	0.2216	0.6190
-4.05	0.940017	2.0113	0.0733	0.1475	0.2410	0.6118
-3.75	0.908721	1.9128	0.0752	0.1438	0.2782	0.5170
-3.45	0.984697	2.0929	0.0731	0.1529	0.2102	0.7273
-3.15	0.971976	2.1412	0.0779	0.1668	0.1920	0.8688
-2.85	1.043735	2.0028	0.0815	0.1632	0.2442	0.6682
-2.55	1.099171	2.0053	0.0850	0.1704	0.2433	0.7005
-2.25	1.046576	1.9491	0.0850	0.1656	0.2645	0.6260
-1.95	1.080399	1.9787	0.0870	0.1722	0.2533	0.6799
-1.65	1.103583	1.9865	0.0882	0.1753	0.2504	0.7000
-1.35	1.049900	2.0167	0.0902	0.1819	0.2390	0.7612
-1.05	0.903084	2.0041	0.0899	0.1801	0.2438	0.7389
-0.75	0.890636	1.9775	0.0895	0.1771	0.2538	0.6977
-0.45	0.786755	1.9412	0.0862	0.1674	0.2675	0.6259
-0.15	0.727012	1.9859	0.0892	0.1771	0.2506	0.7066
0.15	0.399172	1.7303	0.0926	0.1602	0.3471	0.4615
0.45	0.207219	1.8711	0.0882	0.1650	0.2939	0.5613
0.75	0.112814	1.8699	0.0876	0.1638	0.2944	0.5564
1.05	0.053296	2.0838	0.0844	0.1759	0.2137	0.8232
1.35	0.022562	1.9515	0.0830	0.1620	0.2636	0.6145
1.65	0.010901	1.9291	0.0824	0.1589	0.2720	0.5843
1.95	0.002568	2.0470	0.0818	0.1674	0.2276	0.7357
2.25	0.000324	2.0294	0.0810	0.1644	0.2342	0.7020
2.55	0.0	2.0615	0.0818	0.1686	0.2221	0.7592
2.85	0.000325	2.0234	0.0812	0.1644	0.2365	0.6952
3.15	0.000310	2.1177	0.0788	0.1668	0.2009	0.8304
3.45	0.001045	1.8874	0.1095	0.2067	0.2878	0.7182
3.75	0.000612	2.1467	0.0495	0.1064	0.1899	0.5600
4.05	0.0	1.9883	0.0742	0.1475	0.2497	0.5906
4.35	0.0	2.0778	0.0718	0.1493	0.2159	0.6913
4.65	0.000339	1.9382	0.0702	0.1360	0.2686	0.5062
4.95	0.0	2.2561	0.0710	0.1602	0.1487	1.0774

Rep. 3, Time: 167400 s, C0: 919 cpm/g
Average Bulk Density................2.0088 g/cc
Average Gravimetric Water Content...0.0806 g/g
Average Volumetric Water Content....0.1614 cc/cc
Average Porosity....................0.2420 cc/cc
Average Saturation..................0.6858 cc/cc

0% BENTONITE

Low Bulk Density

Water Content

X (cm)	C / C0	Bulk Density (g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.95	1.059424	2.5208	0.0741	0.1867	0.0488	3.8296
-4.65	0.969288	1.9623	0.0724	0.1420	0.2595	0.5473
-4.35	1.009457	2.1485	0.0748	0.1608	0.1892	0.8495
-4.05	0.979451	1.9636	0.0760	0.1493	0.2590	0.5763
-3.75	0.935825	2.0953	0.0767	0.1608	0.2093	0.7680
-3.45	0.983282	1.9962	0.0793	0.1583	0.2467	0.6418
-3.15	1.024435	2.0198	0.0784	0.1583	0.2378	0.6658
-2.85	0.960924	1.9932	0.0797	0.1589	0.2479	0.6413
-2.55	1.076026	2.0935	0.0834	0.1747	0.2100	0.8317
-2.25	1.009606	2.0089	0.0827	0.1662	0.2419	0.6870
-1.95	1.059676	1.9152	0.0843	0.1614	0.2773	0.5820
-1.65	1.009257	2.0560	0.0855	0.1759	0.2241	0.7846
-1.35	1.033288	2.0542	0.0838	0.1722	0.2248	0.7661
-1.05	0.946838	1.9273	0.0508	0.0979	0.2727	0.3590
-0.75	0.851341	2.0566	0.0843	0.1735	0.2239	0.7746
-0.45	0.772135	1.9974	0.0814	0.1626	0.2463	0.6602
-0.15	0.632689	2.0995	0.0806	0.1692	0.2077	0.8147
0.15	0.374230	1.6142	0.0842	0.1360	0.3909	0.3479
0.45	0.209135	1.8499	0.0830	0.1535	0.3019	0.5085
0.75	0.111558	2.0240	0.0833	0.1686	0.2362	0.7138
1.05	0.053289	2.0566	0.0832	0.1710	0.2239	0.7638
1.35	0.019825	1.9315	0.0826	0.1596	0.2711	0.5885
1.65	0.007607	1.9962	0.0857	0.1710	0.2467	0.6932
1.95	0.001599	2.0639	0.0855	0.1765	0.2212	0.7979
2.25	0.000327	2.0161	0.0827	0.1668	0.2392	0.6974
2.55	0.0	2.0016	0.0809	0.1620	0.2447	0.6620
2.85	0.0	2.1316	0.0800	0.1704	0.1956	0.8712
3.15	0.0	1.9291	0.0789	0.1523	0.2720	0.5598
3.45	0.000344	1.9170	0.0776	0.1487	0.2766	0.5375
3.75	0.0	2.0790	0.0721	0.1499	0.2155	0.6956
4.05	0.0	2.0421	0.0752	0.1535	0.2294	0.6692
4.35	0.0	1.9938	0.0715	0.1426	0.2476	0.5760
4.65	0.0	1.9436	0.0693	0.1348	0.2666	0.5056
4.95	0.000569	2.3195	-.1881	-.4363	0.1247	******

Rep. 4, Time: 172200 s, C0: 915 cpm/g
Average Bulk Density................2.0241 g/cc
Average Gravimetric Water Content...0.0711 g/g
Average Volumetric Water Content....0.1415 cc/cc
Average Porosity....................0.2362 cc/cc
Average Saturation..................0.6314 cc/cc

10% BENTONITE

Low Bulk Density

			Water Content			
X (cm)	C / C0	Bulk Density (g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.95	0.974380	1.6523	0.1686	0.2786	0.3812	0.7310
-4.65	1.015872	1.7327	0.1713	0.2967	0.3511	0.8453
-4.35	0.979393	1.7514	0.1753	0.3070	0.3440	0.8924
-4.05	1.050491	1.7575	0.1771	0.3112	0.3418	0.9107
-3.75	1.056351	1.6982	0.1762	0.2992	0.3640	0.8220
-3.45	1.021570	1.7677	0.1768	0.3125	0.3379	0.9246
-3.15	0.981664	1.7738	0.1775	0.3149	0.3357	0.9381
-2.85	1.074058	1.7212	0.1777	0.3058	0.3554	0.8606
-2.55	1.032820	1.7381	0.1791	0.3112	0.3490	0.8918
-2.25	0.992973	1.7557	0.1752	0.3076	0.3424	0.8983
-1.95	1.004094	1.7780	0.1764	0.3137	0.3341	0.9389
-1.65	0.935116	1.7327	0.1779	0.3082	0.3511	0.8780
-1.35	0.960595	1.7514	0.1767	0.3094	0.3440	0.8994
-1.05	0.886383	1.7230	0.1796	0.3094	0.3547	0.8724
-0.75	0.832244	1.7466	0.1779	0.3106	0.3458	0.8982
-0.45	0.689057	1.7303	0.1774	0.3070	0.3520	0.8723
-0.15	0.539557	2.2555	0.1702	0.3838	0.1553	2.4718
0.15	0.359528	2.2367	0.1656	0.3705	0.1623	2.2830
0.45	0.260037	1.7393	0.1751	0.3046	0.3486	0.8739
0.75	0.148875	1.7720	0.1726	0.3058	0.3363	0.9092
1.05	0.097832	1.7079	0.1745	0.2979	0.3603	0.8269
1.35	0.056922	1.7714	0.1760	0.3118	0.3366	0.9266
1.65	0.035580	1.7466	0.1782	0.3112	0.3458	0.9000
1.95	0.021728	1.7236	0.1788	0.3082	0.3544	0.8696
2.25	0.012227	1.7502	0.1751	0.3064	0.3445	0.8895
2.55	0.005744	1.7913	0.1751	0.3137	0.3291	0.9531
2.85	0.002843	1.7369	0.1743	0.3028	0.3495	0.8664
3.15	0.001180	1.7442	0.1739	0.3034	0.3468	0.8749
3.45	0.000233	1.7659	0.1742	0.3076	0.3386	0.9085
3.75	0.0	1.7623	0.1735	0.3058	0.3400	0.8995
4.05	0.000237	1.7357	0.1713	0.2973	0.3499	0.8497
4.35	0.000223	1.8469	0.1695	0.3131	0.3083	1.0155
4.65	0.000228	1.8016	0.1657	0.2986	0.3252	0.9179
4.95	0.000596	1.3804	0.1642	0.2266	0.4830	0.4692

Rep. 1, Time: 852300 s, C0: 1468 cpm/g
Average Bulk Density................1.7670 g/cc
Average Gravimetric Water Content...0.1744 g/g
Average Volumetric Water Content....0.3080 cc/cc
Average Porosity....................0.3382 cc/cc
Average Saturation..................0.9641 cc/cc

10% BENTONITE

Low Bulk Density

			Water Content			
X (cm)	C / C0	Bulk Density (g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.95	0.985580	2.2627	0.1522	0.3445	0.1525	2.2583
-4.65	0.934334	1.8596	0.1615	0.3004	0.3035	0.9896
-4.35	0.964161	1.8233	0.1677	0.3058	0.3171	0.9644
-4.05	1.217382	1.3731	0.4032	0.5536	0.4857	1.1397
-3.75	0.952630	1.8505	0.1679	0.3106	0.3069	1.0121
-3.45	1.029006	1.8185	0.1685	0.3064	0.3189	0.9608
-3.15	1.038896	1.8505	0.1675	0.3100	0.3069	1.0102
-2.85	0.933182	1.7599	0.1676	0.2949	0.3409	0.8652
-2.55	1.014772	1.7478	0.1660	0.2901	0.3454	0.8399
-2.25	1.034554	1.7955	0.1646	0.2955	0.3275	0.9024
-1.95	0.996849	1.7792	0.1654	0.2943	0.3336	0.8822
-1.65	0.993767	1.7798	0.1674	0.2979	0.3334	0.8937
-1.35	0.936525	1.8469	0.1626	0.3004	0.3083	0.9744
-1.05	0.786603	1.7738	0.1574	0.2792	0.3357	0.8318
-0.75	0.729639	1.8989	0.1512	0.2871	0.2888	0.9940
-0.45	0.991808	1.7351	0.1484	0.2575	0.3501	0.7353
-0.15	0.497919	1.7992	0.1394	0.2508	0.3262	0.7690
0.15	0.386957	1.6426	0.1343	0.2206	0.3848	0.5733
0.45	0.249677	1.7696	0.1359	0.2405	0.3372	0.7132
0.75	0.165315	1.8457	0.1424	0.2629	0.3087	0.8516
1.05	0.105455	1.8796	0.1428	0.2683	0.2960	0.9064
1.35	0.063594	1.8578	0.1477	0.2744	0.3042	0.9020
1.65	0.039398	1.8711	0.1495	0.2798	0.2992	0.9352
1.95	0.021955	1.8233	0.1515	0.2762	0.3171	0.8710
2.25	0.012456	1.8421	0.1526	0.2810	0.3101	0.9063
2.55	0.006386	1.8348	0.1545	0.2834	0.3128	0.9062
2.85	0.003338	1.7551	0.1529	0.2683	0.3427	0.7831
3.15	0.000791	1.8511	0.1534	0.2840	0.3067	0.9262
3.45	0.001295	1.8844	0.1543	0.2907	0.2942	0.9880
3.75	0.0	1.8004	0.1541	0.2774	0.3257	0.8517
4.05	0.0	1.8324	0.1547	0.2834	0.3137	0.9035
4.35	0.001043	1.8723	0.1501	0.2810	0.2988	0.9406
4.65	0.0	1.8240	0.1448	0.2641	0.3169	0.8335
4.95	0.0	1.8663	0.1386	0.2587	0.3010	0.8593

Rep. 2, Time: 843300 s, C0: 1237 cpm/g
Average Bulk Density................1.8178 g/cc
Average Gravimetric Water Content...0.1615 g/g
Average Volumetric Water Content....0.2904 cc/cc
Average Porosity....................0.3192 cc/cc
Average Saturation..................0.9316 cc/cc

10% BENTONITE

Med Bulk Density

Water Content

X (cm)	C / C0	Bulk Density (g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.95	0.997947	2.0772	0.1269	0.2635	0.2220	1.1868
-4.65	1.002197	1.9617	0.1303	0.2556	0.2653	0.9637
-4.35	1.035070	1.9581	0.1339	0.2623	0.2666	0.9837
-4.05	1.057117	1.9237	0.1354	0.2605	0.2795	0.9319
-3.75	0.976770	1.9460	0.1373	0.2671	0.2712	0.9852
-3.45	1.017912	1.9436	0.1371	0.2665	0.2721	0.9796
-3.15	0.987094	1.9188	0.1364	0.2617	0.2813	0.9302
-2.85	0.999238	1.8989	0.1359	0.2581	0.2888	0.8935
-2.55	1.034646	1.9067	0.1404	0.2677	0.2859	0.9366
-2.25	1.031863	1.9424	0.1378	0.2677	0.2725	0.9825
-1.95	0.982161	1.9388	0.1375	0.2665	0.2739	0.9732
-1.65	0.987043	1.9406	0.1370	0.2659	0.2732	0.9734
-1.35	0.901569	1.9611	0.1362	0.2671	0.2655	1.0062
-1.05	0.823149	1.9430	0.1322	0.2568	0.2723	0.9433
-0.75	0.730448	1.9956	0.1284	0.2563	0.2526	1.0145
-0.45	0.641205	1.7980	0.1260	0.2266	0.3266	0.6939
-0.15	0.551944	1.7647	0.1219	0.2151	0.3391	0.6346
0.15	0.389194	1.8149	0.1179	0.2139	0.3203	0.6680
0.45	0.278403	1.8584	0.1246	0.2315	0.3040	0.7615
0.75	0.200267	1.8983	0.1308	0.2484	0.2890	0.8594
1.05	0.138515	1.9001	0.1352	0.2569	0.2884	0.8908
1.35	0.088902	1.9104	0.1363	0.2605	0.2845	0.9156
1.65	0.058304	1.9291	0.1366	0.2635	0.2775	0.9496
1.95	0.032660	1.9285	0.1379	0.2659	0.2777	0.9575
2.25	0.021474	1.8856	0.1401	0.2641	0.2938	0.8990
2.55	0.008729	1.9327	0.1398	0.2701	0.2761	0.9783
2.85	0.005344	1.8941	0.1398	0.2647	0.2906	0.9109
3.15	0.002406	1.8699	0.1396	0.2611	0.2997	0.8712
3.45	0.001201	1.8735	0.1390	0.2605	0.2983	0.8732
3.75	0.001740	1.9388	0.1403	0.2720	0.2739	0.9930
4.05	0.001752	1.9255	0.1387	0.2671	0.2788	0.9580
4.35	0.001733	1.9472	0.1366	0.2659	0.2707	0.9823
4.65	0.001748	1.9303	0.1327	0.2562	0.2770	0.9250
4.95	0.0	2.2978	0.1284	0.2949	0.1394	2.1155

Rep. 1, Time: 1039500 s, C0: 537 cpm/g
Average Bulk Density................1.9281 g/cc
Average Gravimetric Water Content...0.1343 g/g
Average Volumetric Water Content....0.2589 cc/cc
Average Porosity....................0.2779 cc/cc
Average Saturation..................0.9565 cc/cc

10% BENTONITE

Med Bulk Density

Water Content

X (cm)	C / C0	Bulk Density (g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.95	1.044352	1.5079	0.1291	0.1946	0.4353	0.4471
-4.65	0.989325	1.9490	0.1287	0.2508	0.2700	0.9289
-4.35	1.012180	1.9231	0.1307	0.2514	0.2798	0.8987
-4.05	1.034824	1.9394	0.1324	0.2568	0.2736	0.9386
-3.75	1.023690	1.8959	0.1352	0.2562	0.2899	0.8838
-3.45	1.041890	1.8814	0.1343	0.2526	0.2954	0.8553
-3.15	1.028084	1.9255	0.1347	0.2593	0.2788	0.9298
-2.85	1.049144	1.9140	0.1355	0.2593	0.2831	0.9157
-2.55	0.987956	1.9448	0.1361	0.2647	0.2716	0.9746
-2.25	1.027018	1.8886	0.1366	0.2581	0.2927	0.8818
-1.95	1.003766	1.8983	0.1359	0.2581	0.2890	0.8928
-1.65	0.970332	1.8838	0.1344	0.2532	0.2945	0.8599
-1.35	0.915938	1.9309	0.1324	0.2556	0.2768	0.9235
-1.05	0.834386	1.9351	0.1312	0.2538	0.2752	0.9223
-0.75	0.774162	1.9237	0.1298	0.2496	0.2795	0.8930
-0.45	0.647353	1.8777	0.1265	0.2375	0.2967	0.8004
-0.15	0.534781	2.1962	0.1291	0.2834	0.1774	1.5974
0.15	0.383929	1.7702	0.1273	0.2254	0.3370	0.6689
0.45	0.274715	1.8264	0.1254	0.2290	0.3160	0.7249
0.75	0.193853	1.9176	0.1292	0.2478	0.2818	0.8793
1.05	0.136044	1.9194	0.1319	0.2532	0.2811	0.9008
1.35	0.090717	1.8729	0.1339	0.2508	0.2985	0.8401
1.65	0.053000	1.9364	0.1342	0.2599	0.2748	0.9458
1.95	0.030327	1.9176	0.1330	0.2550	0.2818	0.9051
2.25	0.013948	2.1255	0.1646	0.3499	0.2039	1.7159
2.55	0.007774	1.9067	0.1372	0.2617	0.2859	0.9154
2.85	0.003008	1.8953	0.1368	0.2593	0.2902	0.8935
3.15	0.002405	1.8965	0.1373	0.2605	0.2897	0.8991
3.45	0.001213	1.8796	0.1350	0.2538	0.2960	0.8574
3.75	0.002951	1.9321	0.1358	0.2623	0.2764	0.9491
4.05	0.000616	1.8511	0.1345	0.2490	0.3067	0.8119
4.35	0.0	1.8904	0.1352	0.2556	0.2920	0.8756
4.65	0.000587	1.9424	0.1319	0.2562	0.2725	0.9403
4.95	0.001437	2.3806	0.1307	0.3112	0.1084	2.8711

Rep. 2, Time: 1044000 s, C0: 530 cpm/g
Average Bulk Density................1.9199 g/cc
Average Gravimetric Water Content...0.1337 g/g
Average Volumetric Water Content....0.2569 cc/cc
Average Porosity....................0.2809 cc/cc
Average Saturation..................0.9746 cc/cc

25% BENTONITE

Low Bulk Density

Water Content

X (cm)	C / C0	Bulk Density (g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.90	1.078176	1.5937	0.3441	0.5485	0.4075	1.3457
-4.65	1.020205	1.2843	0.3732	0.4793	0.5226	0.9171
-4.35	1.022898	1.2957	0.3857	0.4998	0.5183	0.9643
-4.05	1.007278	1.2879	0.3829	0.4932	0.5212	0.9461
-3.75	1.070570	1.2685	0.3897	0.4944	0.5284	0.9356
-3.45	1.054667	1.2540	0.3889	0.4877	0.5338	0.9136
-3.15	1.029153	1.2963	0.3832	0.4968	0.5181	0.9589
-2.85	1.007715	1.3175	0.3807	0.5016	0.5102	0.9831
-2.55	1.017801	1.2613	0.3891	0.4907	0.5311	0.9240
-2.25	1.019014	1.2824	0.3883	0.4980	0.5233	0.9517
-1.95	0.981821	1.2849	0.3843	0.4938	0.5224	0.9453
-1.65	0.956902	1.2818	0.3828	0.4907	0.5235	0.9375
-1.35	0.902905	1.2734	0.3844	0.4895	0.5266	0.9296
-1.05	0.859793	1.2734	0.3844	0.4895	0.5266	0.9296
-0.75	0.745142	1.2921	0.3887	0.5022	0.5197	0.9664
-0.45	0.664979	1.2510	0.3899	0.4877	0.5349	0.9117
-0.15	0.483131	1.5127	0.3664	0.5542	0.4377	1.2663
0.15	0.337992	1.8191	0.3731	0.6787	0.3237	2.0964
0.45	0.253593	1.3000	0.3882	0.5046	0.5167	0.9766
0.75	0.166203	1.3652	0.3825	0.5222	0.4925	1.0603
1.05	0.113128	1.1422	0.3884	0.4436	0.5754	0.7710
1.35	0.069470	1.2927	0.3782	0.4889	0.5194	0.9413
1.65	0.043276	1.2685	0.3873	0.4913	0.5284	0.9298
1.95	0.024726	1.2752	0.3872	0.4938	0.5260	0.9388
2.25	0.013759	1.2685	0.3816	0.4841	0.5284	0.9161
2.55	0.006791	1.3266	0.3836	0.5089	0.5069	1.0040
2.85	0.003301	1.2794	0.3831	0.4901	0.5244	0.9347
3.15	0.001309	1.2903	0.3869	0.4992	0.5203	0.9594
3.45	0.001109	1.2698	0.3841	0.4877	0.5280	0.9238
3.75	0.000212	1.3266	0.3809	0.5052	0.5069	0.9968
4.05	0.0	1.2522	0.3847	0.4817	0.5345	0.9012
4.35	0.0	1.3199	0.3810	0.5028	0.5093	0.9872
4.65	0.000204	1.3773	0.3554	0.4895	0.4880	1.0032
4.90	0.0	1.2483	0.3195	0.3989	0.5359	0.7442

Rep. 1, Time: 777600 s, C0: 2146 cpm/g
Average Bulk Density................1.3157 g/cc
Average Gravimetric Water Content...0.3798 g/g
Average Volumetric Water Content....0.4991 cc/cc
Average Porosity....................0.5109 cc/cc
Average Saturation..................0.9944 cc/cc

25% BENTONITE

Low Bulk Density

X (cm)	C / C0	Bulk Density (g/cc)	Water Content Gravimetric (g/g)	Water Content Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.90	1.018168	1.3308	0.3406	0.4533	0.5053	0.8971
-4.65	0.982430	1.3338	0.4051	0.5403	0.5042	1.0717
-4.35	1.054911	1.3187	0.3749	0.4944	0.5098	0.9698
-4.05	1.003801	1.3024	0.3768	0.4907	0.5158	0.9513
-3.75	1.031605	1.2601	0.4384	0.5524	0.5316	1.0392
-3.45	1.020718	1.3205	0.3268	0.4315	0.5091	0.8476
-3.15	1.075341	1.2692	0.4081	0.5179	0.5282	0.9806
-2.85	1.069899	1.3012	0.3679	0.4787	0.5163	0.9271
-2.55	1.063556	1.2861	0.3647	0.4690	0.5219	0.8986
-2.25	1.032118	1.2716	0.4392	0.5584	0.5273	1.0590
-1.95	0.963837	1.3241	0.3031	0.4013	0.5078	0.7903
-1.65	0.939375	1.2468	0.4455	0.5554	0.5365	1.0352
-1.35	0.964944	1.3072	0.3555	0.4648	0.5140	0.9041
-1.05	0.879305	1.2939	0.3919	0.5071	0.5190	0.9770
-0.75	0.781990	1.3254	0.3324	0.4406	0.5073	0.8685
-0.45	0.687382	1.3127	0.6064	0.7959	0.5120	1.5545
-0.15	0.524056	1.5870	0.2525	0.4007	0.4100	0.9772
0.15	0.291832	1.6275	0.3205	0.5216	0.3950	1.3205
0.45	0.227252	1.3453	0.3500	0.4708	0.4999	0.9418
0.75	0.162170	1.2915	0.3617	0.4672	0.5199	0.8986
1.05	0.102448	1.3519	0.3728	0.5040	0.4974	1.0133
1.35	0.066543	1.2692	0.3800	0.4823	0.5282	0.9131
1.65	0.041578	1.3000	0.3831	0.4980	0.5167	0.9637
1.95	0.025359	1.2788	0.3875	0.4956	0.5246	0.9447
2.25	0.013246	1.2752	0.3839	0.4895	0.5260	0.9308
2.55	0.006053	1.2837	0.3847	0.4938	0.5228	0.9444
2.85	0.003690	1.2818	0.3871	0.4962	0.5235	0.9478
3.15	0.002139	1.2637	0.3864	0.4883	0.5302	0.9210
3.45	0.000264	1.2794	0.3836	0.4907	0.5244	0.9359
3.75	0.000262	1.2879	0.3867	0.4980	0.5212	0.9554
4.05	0.0	1.2897	0.3857	0.4974	0.5206	0.9555
4.35	0.0	1.2450	0.3879	0.4829	0.5372	0.8989
4.65	0.000500	1.3519	0.3759	0.5083	0.4974	1.0218
4.90	0.001474	1.7188	0.3465	0.5956	0.3610	1.6496

Rep. 2, Time: 765900 s, C0: 1789 cpm/g
Average Bulk Density................1.3274 g/cc
Average Gravimetric Water Content...0.3792 g/g
Average Volumetric Water Content....0.5009 cc/cc
Average Porosity....................0.5065 cc/cc
Average Saturation..................0.9972 cc/cc

25% BENTONITE

Med Bulk Density

X (cm)	C / C0	Bulk Density (g/cc)	Water Content Gravimetric (g/g)	Water Content Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.95	0.941069	1.6674	0.2686	0.4478	0.3801	1.1781
-4.65	1.012364	1.5097	0.2730	0.4122	0.4388	0.9393
-4.35	0.985875	1.5018	0.2761	0.4146	0.4417	0.9386
-4.05	0.980515	1.4928	0.2781	0.4152	0.4451	0.9329
-3.75	1.017962	1.4946	0.2774	0.4146	0.4444	0.9329
-3.45	1.006572	1.5000	0.2776	0.4164	0.4424	0.9413
-3.15	1.009877	1.4867	0.2797	0.4158	0.4473	0.9295
-2.85	1.057014	1.4619	0.2803	0.4098	0.4565	0.8975
-2.55	1.017177	1.5230	0.2718	0.4140	0.4338	0.9542
-2.25	0.971431	1.4861	0.2757	0.4098	0.4475	0.9156
-1.95	0.999225	1.4879	0.2774	0.4128	0.4469	0.9237
-1.65	1.003144	1.4867	0.2772	0.4122	0.4473	0.9214
-1.35	0.919365	1.4916	0.2751	0.4104	0.4455	0.9211
-1.05	0.880423	1.5024	0.2743	0.4122	0.4415	0.9336
-0.75	0.781055	1.4885	0.2753	0.4098	0.4466	0.9174
-0.45	0.671936	1.4656	0.2689	0.3940	0.4552	0.8657
-0.15	0.549967	1.5526	0.2608	0.4049	0.4228	0.9576
0.15	0.338566	1.8898	0.2558	0.4835	0.2975	1.6254
0.45	0.283052	1.4499	0.2639	0.3826	0.4610	0.8298
0.75	0.191276	1.5296	0.2702	0.4134	0.4314	0.9583
1.05	0.124702	1.5127	0.2729	0.4128	0.4377	0.9432
1.35	0.081914	1.5133	0.2712	0.4104	0.4374	0.9381
1.65	0.048085	1.4891	0.2703	0.4025	0.4464	0.9016
1.95	0.024951	1.5429	0.2687	0.4146	0.4264	0.9722
2.25	0.014039	1.5357	0.2712	0.4164	0.4291	0.9704
2.55	0.005010	1.5369	0.2662	0.4092	0.4287	0.9545
2.85	0.003563	1.5127	0.2705	0.4091	0.4377	0.9349
3.15	0.001014	1.5181	0.2707	0.4110	0.4356	0.9434
3.45	0.001014	1.5194	0.2701	0.4104	0.4352	0.9429
3.75	0.002047	1.5042	0.2716	0.4085	0.4408	0.9268
4.05	0.000493	1.5623	0.2665	0.4164	0.4192	0.9932
4.35	0.000982	1.5677	0.2668	0.4182	0.4172	1.0024
4.65	0.002009	1.5327	0.2618	0.4013	0.4302	0.9327
4.95	0.001168	1.3181	0.2623	0.3457	0.5100	0.6778

Rep. 1, Time: 930600 s, C0: 784 cpm/g
Average Bulk Density................1.5187 g/cc
Average Gravimetric Water Content...0.2711 g/g
Average Volumetric Water Content....0.4115 cc/cc
Average Porosity....................0.4354 cc/cc
Average Saturation..................0.9544 cc/cc

25% BENTONITE

Med Bulk Density

Water Content

X (cm)	C / C0	Bulk Density (g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.95	1.040553	1.3145	0.2575	0.3384	0.5113	0.6619
-4.65	0.975752	1.5417	0.2658	0.4097	0.4269	0.9599
-4.35	1.004881	1.5520	0.2664	0.4134	0.4231	0.9771
-4.05	1.007050	1.5327	0.2721	0.4170	0.4302	0.9692
-3.75	1.019553	1.4988	0.2758	0.4134	0.4428	0.9335
-3.45	1.023198	1.4867	0.2760	0.4104	0.4473	0.9174
-3.15	1.025557	1.5042	0.2760	0.4152	0.4408	0.9419
-2.85	1.020922	1.4885	0.2781	0.4140	0.4466	0.9269
-2.55	1.025105	1.5109	0.2760	0.4170	0.4383	0.9513
-2.25	1.017432	1.4770	0.2709	0.4001	0.4509	0.8873
-1.95	0.990642	1.5085	0.2672	0.4031	0.4392	0.9178
-1.65	0.953760	1.5194	0.2697	0.4097	0.4352	0.9416
-1.35	0.924742	1.5272	0.2639	0.4031	0.4323	0.9325
-1.05	0.882116	1.4958	0.2691	0.4025	0.4439	0.9066
-0.75	0.760887	1.5194	0.2665	0.4049	0.4352	0.9305
-0.45	0.729702	1.4529	0.2629	0.3820	0.4599	0.8305
-0.15	0.514215	1.8215	0.2468	0.4496	0.3228	1.3927
0.15	0.397298	1.4366	0.2394	0.3439	0.4660	0.7380
0.45	0.285687	1.5091	0.2583	0.3898	0.4390	0.8879
0.75	0.196413	1.5115	0.2643	0.3995	0.4381	0.9118
1.05	0.130942	1.5115	0.2651	0.4007	0.4381	0.9146
1.35	0.085909	1.5091	0.2679	0.4043	0.4390	0.9210
1.65	0.045315	1.5236	0.2697	0.4110	0.4336	0.9478
1.95	0.027959	1.5091	0.2691	0.4061	0.4390	0.9251
2.25	0.014789	1.5042	0.2760	0.4152	0.4408	0.9419
2.55	0.007197	1.4922	0.2750	0.4104	0.4453	0.9215
2.85	0.003076	1.4964	0.2742	0.4104	0.4437	0.9248
3.15	0.000514	1.4934	0.2695	0.4025	0.4448	0.9048
3.45	0.002539	1.5109	0.2728	0.4122	0.4383	0.9403
3.75	0.000512	1.4994	0.2741	0.4110	0.4426	0.9285
4.05	0.000507	1.5127	0.2721	0.4116	0.4377	0.9404
4.35	0.0	1.5085	0.2704	0.4079	0.4392	0.9288
4.65	0.000990	1.5490	0.2673	0.4140	0.4242	0.9760
4.95	0.002168	1.7690	0.2675	0.4732	0.3424	1.3820

Rep. 2, Time: 935100 s, C0: 787 cpm/g
Average Bulk Density................1.5176 g/cc
Average Gravimetric Water Content...0.2680 g/g
Average Volumetric Water Content....0.4067 cc/cc
Average Porosity....................0.4358 cc/cc
Average Saturation..................0.9416 cc/cc

50% BENTONITE

Low Bulk Density

X (cm)	C / C0	Bulk Density (g/cc)	Water Content Gravimetric (g/g)	Water Content Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.95	1.069150	0.8685	0.6305	0.5475	0.6807	0.8044
-4.65	0.946509	0.8854	0.6676	0.5911	0.6745	0.8763
-4.35	0.994941	0.9295	0.6730	0.6255	0.6583	0.9502
-4.05	1.040397	0.9120	0.6746	0.6152	0.6647	0.9256
-3.75	1.033853	0.9295	0.6743	0.6267	0.6583	0.9521
-3.45	1.074085	0.9355	0.6764	0.6328	0.6560	0.9645
-3.15	1.021997	0.9259	0.6749	0.6249	0.6596	0.9474
-2.85	1.038549	0.9132	0.6744	0.6158	0.6643	0.9271
-2.55	1.072262	0.9434	0.6605	0.6231	0.6532	0.9540
-2.25	0.972486	0.9295	0.6658	0.6189	0.6583	0.9401
-1.95	0.944796	0.9253	0.6884	0.6370	0.6598	0.9654
-1.65	0.894103	0.9222	0.6776	0.6249	0.6609	0.9455
-1.35	0.792309	0.9355	0.6576	0.6152	0.6560	0.9378
-1.05	0.741088	0.9410	0.6692	0.6297	0.6540	0.9628
-0.75	0.704874	0.8999	0.6729	0.6056	0.6692	0.9050
-0.45	0.654593	0.9349	0.6710	0.6273	0.6563	0.9559
-0.15	0.495916	1.1525	0.6508	0.7500	0.5763	1.3015
0.15	0.410143	1.1060	0.6639	0.7343	0.5934	1.2375
0.45	0.325312	0.8793	0.6632	0.5832	0.6767	0.8618
0.75	0.237296	0.9531	0.6639	0.6328	0.6496	0.9741
1.05	0.199586	0.8896	0.6753	0.6007	0.6729	0.8927
1.35	0.122216	0.9428	0.6603	0.6225	0.6534	0.9527
1.65	0.098892	0.9368	0.6839	0.6406	0.6556	0.9771
1.95	0.060822	0.9120	0.6759	0.6164	0.6647	0.9274
2.25	0.042441	0.9162	0.6702	0.6140	0.6632	0.9259
2.55	0.025758	0.9380	0.6592	0.6183	0.6552	0.9437
2.85	0.017212	0.9053	0.6636	0.6007	0.6672	0.9004
3.15	0.011141	0.9368	0.6716	0.6291	0.6556	0.9596
3.45	0.007118	0.9440	0.6645	0.6273	0.6529	0.9608
3.75	0.003755	0.9519	0.6667	0.6346	0.6501	0.9762
4.05	0.002681	0.9065	0.6727	0.6098	0.6667	0.9146
4.35	0.001631	0.9640	0.6614	0.6376	0.6456	0.9876
4.65	0.001679	0.9368	0.6619	0.6201	0.6556	0.9458
4.95	0.000968	0.7385	0.6121	0.4521	0.7285	0.6205

Rep. 1, Time: 1374300 s, C0: 4227 cpm/g
Average Bulk Density................0.9306 g/cc
Average Gravimetric Water Content...0.6662 g/g
Average Volumetric Water Content....0.6202 cc/cc
Average Porosity....................0.6579 cc/cc
Average Saturation..................0.9463 cc/cc

50% BENTONITE

Low Bulk Density

X (cm)	C / C0	Bulk Density (g/cc)	Water Content		Porosity (cc/cc)	Saturation (cc/cc)
			Gravimetric (g/g)	Volumetric (cc/cc)		
-4.95	0.955916	0.8165	0.6232	0.5089	0.6998	0.7271
-4.65	1.036114	0.9615	0.6612	0.6358	0.6465	0.9834
-4.35	0.972574	0.9507	0.6523	0.6201	0.6505	0.9532
-4.05	0.997923	0.9337	0.6725	0.6279	0.6567	0.9562
-3.75	1.038670	0.9235	0.6806	0.6285	0.6605	0.9516
-3.45	1.038225	0.9138	0.6772	0.6189	0.6640	0.9320
-3.15	1.038797	0.9216	0.6800	0.6267	0.6612	0.9479
-2.85	0.941952	0.9470	0.6650	0.6297	0.6518	0.9661
-2.55	0.991320	0.9071	0.6762	0.6134	0.6665	0.9204
-2.25	1.048822	0.9319	0.6764	0.6303	0.6574	0.9589
-1.95	0.964393	0.9682	0.6792	0.6575	0.6441	1.0209
-1.65	1.016199	0.9059	0.6678	0.6050	0.6669	0.9071
-1.35	0.816326	0.9150	0.6823	0.6243	0.6636	0.9408
-1.05	0.799280	0.9192	0.6785	0.6237	0.6620	0.9421
-0.75	0.683514	0.9222	0.6776	0.6249	0.6609	0.9455
-0.45	0.601197	0.9452	0.6777	0.6406	0.6525	0.9818
-0.15	0.484548	1.1712	0.6533	0.7651	0.5694	1.3437
0.15	0.427631	1.1144	0.6448	0.7186	0.5903	1.2174
0.45	0.344578	0.9555	0.6711	0.6412	0.6487	0.9884
0.75	0.240975	0.9216	0.6787	0.6255	0.6612	0.9461
1.05	0.190494	0.9380	0.6778	0.6358	0.6552	0.9704
1.35	0.133533	0.9192	0.6824	0.6273	0.6620	0.9475
1.65	0.088948	0.9216	0.6715	0.6189	0.6612	0.9360
1.95	0.065372	0.9343	0.6772	0.6328	0.6565	0.9639
2.25	0.042700	0.9410	0.6750	0.6352	0.6540	0.9712
2.55	0.028475	0.9355	0.6686	0.6255	0.6560	0.9534
2.85	0.018820	0.9150	0.6783	0.6207	0.6636	0.9353
3.15	0.011990	0.9083	0.6880	0.6249	0.6660	0.9382
3.45	0.008003	0.9011	0.6861	0.6183	0.6687	0.9245
3.75	0.004289	0.9609	0.6742	0.6479	0.6467	1.0018
4.05	0.002874	0.9216	0.6721	0.6195	0.6612	0.9369
4.35	0.002334	0.9458	0.6498	0.6146	0.6523	0.9423
4.65	0.001063	0.9688	0.6525	0.6322	0.6438	0.9819
4.95	0.000749	0.7857	0.6223	0.4889	0.7112	0.6875

Rep. 2, Time: 1379100 s, C0: 4106 cpm/g
Average Bulk Density................0.9366 g/cc
Average Gravimetric Water Content...0.6692 g/g
Average Volumetric Water Content....0.6267 cc/cc
Average Porosity....................0.6557 cc/cc
Average Saturation..................0.9595 cc/cc

50% BENTONITE

Med Bulk Density

			Water Content			
X (cm)	C / C0	Bulk Density (g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.95	0.769720	1.7303	0.3032	0.5246	0.3639	1.4417
-4.65	1.010530	1.5369	0.3079	0.4732	0.4350	1.0879
-4.35	1.054688	1.5073	0.3063	0.4617	0.4459	1.0356
-4.05	1.075613	1.4861	0.3074	0.4569	0.4536	1.0072
-3.75	0.979918	1.4668	0.3070	0.4502	0.4607	0.9772
-3.45	1.034364	1.4916	0.3063	0.4569	0.4516	1.0116
-3.15	1.044707	1.4656	0.3052	0.4472	0.4612	0.9697
-2.85	0.962685	1.4976	0.3095	0.4635	0.4494	1.0314
-2.55	0.943867	1.4390	0.3070	0.4418	0.4710	0.9380
-2.25	0.931837	1.5157	0.3066	0.4648	0.4427	1.0497
-1.95	0.884269	1.4813	0.3044	0.4508	0.4554	0.9900
-1.65	0.908868	1.4493	0.3090	0.4478	0.4672	0.9586
-1.35	0.865396	1.4492	0.3107	0.4502	0.4672	0.9637
-1.05	0.743562	1.5133	0.3055	0.4623	0.4436	1.0421
-0.75	0.797787	1.4196	0.3065	0.4351	0.4781	0.9102
-0.45	0.671366	1.4251	0.3049	0.4345	0.4761	0.9127
-0.15	0.664132	1.2178	0.2948	0.3590	0.5523	0.6500
0.15	0.470711	1.3665	0.2968	0.4055	0.4976	0.8149
0.45	0.348245	1.4221	0.3085	0.4388	0.4772	0.9195
0.75	0.266420	1.4353	0.3107	0.4460	0.4723	0.9444
1.05	0.207537	1.4402	0.3105	0.4472	0.4705	0.9505
1.35	0.142846	1.4462	0.3101	0.4484	0.4683	0.9576
1.65	0.093669	1.4547	0.3091	0.4496	0.4652	0.9666
1.95	0.064200	1.4378	0.3119	0.4484	0.4714	0.9513
2.25	0.037344	1.4517	0.3114	0.4521	0.4663	0.9695
2.55	0.027127	1.4583	0.3108	0.4533	0.4639	0.9772
2.85	0.013045	1.4601	0.3092	0.4515	0.4632	0.9747
3.15	0.009103	1.4486	0.3071	0.4448	0.4674	0.9516
3.45	0.005944	1.4789	0.3049	0.4509	0.4563	0.9881
3.75	0.003053	1.4396	0.3060	0.4406	0.4707	0.9359
4.05	0.0	1.4384	0.3080	0.4430	0.4712	0.9402
4.35	0.0	1.5055	0.3051	0.4593	0.4465	1.0286
4.65	0.001853	1.5810	0.3024	0.4780	0.4188	1.1416
4.95	0.0	1.7496	0.3026	0.5294	0.3568	1.4840

Rep. 1, Time: 2235600 s, C0: 412 cpm/g
Average Bulk Density................1.4737 g/cc
Average Gravimetric Water Content...0.3067 g/g
Average Volumetric Water Content....0.4520 cc/cc
Average Porosity....................0.4582 cc/cc
Average Saturation..................0.9963 cc/cc

50% BENTONITE

Med Bulk Density

			Water Content			
X (cm)	C / C0	Bulk Density (g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.95	0.824954	1.7019	0.3047	0.5185	0.3743	1.3853
-4.65	0.975285	1.5000	0.3050	0.4575	0.4485	1.0200
-4.35	1.016744	1.4770	0.3101	0.4581	0.4570	1.0025
-4.05	1.074345	1.4353	0.3078	0.4418	0.4723	0.9354
-3.75	1.025676	1.4698	0.3018	0.4436	0.4596	0.9651
-3.45	1.014111	1.4795	0.3060	0.4527	0.4561	0.9925
-3.15	1.021513	1.4378	0.3094	0.4448	0.4714	0.9436
-2.85	1.029882	1.4680	0.3092	0.4539	0.4603	0.9860
-2.55	1.023855	1.4710	0.3102	0.4563	0.4592	0.9937
-2.25	0.970440	1.4571	0.3086	0.4496	0.4643	0.9684
-1.95	0.910446	1.4789	0.3077	0.4551	0.4563	0.9973
-1.65	0.937771	1.4680	0.3100	0.4551	0.4603	0.9887
-1.35	0.824251	1.4764	0.3078	0.4545	0.4572	0.9941
-1.05	0.875027	1.4450	0.3099	0.4478	0.4687	0.9554
-0.75	0.766636	1.4692	0.3081	0.4527	0.4599	0.9844
-0.45	0.700474	1.4190	0.3096	0.4394	0.4783	0.9186
-0.15	0.530646	1.5858	0.2942	0.4666	0.4170	1.1189
0.15	0.390056	1.5157	0.2891	0.4382	0.4427	0.9896
0.45	0.316700	1.4535	0.3085	0.4484	0.4656	0.9630
0.75	0.254918	1.4897	0.3059	0.4557	0.4523	1.0075
1.05	0.193807	1.4251	0.3134	0.4466	0.4761	0.9381
1.35	0.133577	1.4861	0.3074	0.4569	0.4536	1.0072
1.65	0.092301	1.4650	0.3090	0.4527	0.4614	0.9810
1.95	0.064198	1.4789	0.3118	0.4611	0.4563	1.0106
2.25	0.042240	1.4644	0.3075	0.4502	0.4616	0.9753
2.55	0.020327	1.4861	0.3054	0.4539	0.4536	1.0005
2.85	0.010444	1.5151	0.3035	0.4599	0.4430	1.0383
3.15	0.007823	1.4710	0.3053	0.4490	0.4592	0.9779
3.45	0.003886	1.4807	0.3037	0.4496	0.4556	0.9868
3.75	0.002889	1.4940	0.3018	0.4509	0.4507	1.0002
4.05	0.0	1.5351	0.3004	0.4611	0.4356	1.0585
4.35	0.0	1.4988	0.3036	0.4551	0.4490	1.0136
4.65	0.0	1.6233	0.3012	0.4889	0.4032	1.2126
4.95	0.0	1.3362	0.2976	0.3977	0.5087	0.7817

Rep. 2, Time: 2239200 s, C0: 420 cpm/g
Average Bulk Density................1.4841 g/cc
Average Gravimetric Water Content...0.3057 g/g
Average Volumetric Water Content....0.4536 cc/cc
Average Porosity....................0.4544 cc/cc
Average Saturation..................1.0027 cc/cc

75% BENTONITE

Low Bulk Density

			Water Content			
X (cm)	C / C0	Bulk Density (g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.95	1.213326	0.6618	0.7936	0.5252	0.7585	0.6924
-4.65	1.077217	0.8159	0.8356	0.6817	0.7022	0.9708
-4.35	1.050276	0.8098	0.8321	0.6739	0.7044	0.9566
-4.05	0.999944	0.8056	0.8357	0.6733	0.7060	0.9536
-3.75	1.012860	0.8038	0.8459	0.6799	0.7066	0.9622
-3.45	0.993365	0.8129	0.8379	0.6811	0.7033	0.9684
-3.15	0.981453	0.8002	0.8421	0.6739	0.7080	0.9518
-2.85	1.012050	0.7971	0.8484	0.6763	0.7091	0.9538
-2.55	0.963466	0.8062	0.8471	0.6829	0.7058	0.9676
-2.25	0.920707	0.7790	0.8549	0.6660	0.7157	0.9306
-1.95	0.875312	0.8104	0.8561	0.6938	0.7042	0.9852
-1.65	0.848979	0.7935	0.8522	0.6763	0.7104	0.9520
-1.35	0.820457	0.8014	0.8529	0.6835	0.7075	0.9661
-1.05	0.703143	0.8044	0.8422	0.6775	0.7064	0.9590
-0.75	0.689684	0.7911	0.8472	0.6702	0.7113	0.9423
-0.45	0.614948	0.7947	0.8388	0.6666	0.7100	0.9389
-0.15	0.472668	0.9277	0.7902	0.7331	0.6614	1.1083
0.15	0.401216	0.8449	0.8019	0.6775	0.6916	0.9795
0.45	0.308688	0.8745	0.8334	0.7289	0.6808	1.0705
0.75	0.274912	0.7923	0.8391	0.6648	0.7108	0.9352
1.05	0.211221	0.8171	0.8462	0.6914	0.7018	0.9852
1.35	0.169418	0.7826	0.8533	0.6678	0.7144	0.9348
1.65	0.130114	0.8050	0.8431	0.6787	0.7062	0.9610
1.95	0.099455	0.7875	0.8534	0.6720	0.7126	0.9431
2.25	0.067871	0.8032	0.8450	0.6787	0.7069	0.9601
2.55	0.050173	0.8256	0.8646	0.7137	0.6987	1.0215
2.85	0.035974	0.7808	0.8568	0.6690	0.7150	0.9357
3.15	0.023396	0.8038	0.8556	0.6878	0.7066	0.9733
3.45	0.015172	0.8159	0.8474	0.6914	0.7022	0.9846
3.75	0.010014	0.7845	0.8529	0.6690	0.7137	0.9374
4.05	0.006233	0.8020	0.8455	0.6781	0.7073	0.9587
4.35	0.005001	0.8092	0.8462	0.6847	0.7047	0.9717
4.65	0.001720	0.8304	0.8275	0.6872	0.6969	0.9860
4.95	0.003492	0.6817	0.8236	0.5614	0.7512	0.7474

Rep. 1, Time: 1964700 s, C0: 2538 cpm/g
Average Bulk Density................0.8017 g/cc
Average Gravimetric Water Content...0.8408 g/g
Average Volumetric Water Content....0.6740 cc/cc
Average Porosity....................0.7074 cc/cc
Average Saturation..................0.9543 cc/cc

75% BENTONITE

Low Bulk Density

X	C / C0	Bulk Density	Water Content		Porosity	Saturation
(cm)		(g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	(cc/cc)	(cc/cc)
-4.95	1.133476	0.5596	0.7451	0.4170	0.7958	0.5240
-4.65	1.021968	0.8751	0.7756	0.6787	0.6806	0.9972
-4.55	1.043753	0.8582	0.7796	0.6690	0.6868	0.9741
-4.05	1.003190	0.8449	0.7976	0.6739	0.6916	0.9743
-3.75	1.011149	0.8395	0.8035	0.6745	0.6936	0.9724
-3.45	0.902247	0.8455	0.8049	0.6805	0.6914	0.9842
-3.15	0.967718	0.8310	0.8051	0.6690	0.6967	0.9603
-2.85	0.937431	0.8201	0.8195	0.6720	0.7007	0.9591
-2.55	0.941226	0.8376	0.8146	0.6823	0.6943	0.9828
-2.25	0.897700	0.8207	0.8277	0.6793	0.7005	0.9698
-1.95	0.948221	0.8189	0.8214	0.6727	0.7011	0.9594
-1.65	0.916093	0.8274	0.8210	0.6793	0.6980	0.9731
-1.55	0.921079	0.8086	0.8184	0.6618	0.7049	0.9388
-1.05	0.843589	0.8231	0.8098	0.6666	0.6996	0.9529
-0.75	0.700137	0.8310	0.8167	0.6787	0.6967	0.9741
-0.45	0.646872	0.9083	0.8303	0.7542	0.6685	1.1283
-0.15	0.548064	0.9216	0.7770	0.7162	0.6636	1.0792
0.15	0.404146	0.9241	0.7417	0.6853	0.6528	1.0341
0.45	0.314804	0.8231	0.7841	0.6455	0.6996	0.9226
0.75	0.272663	0.8425	0.8099	0.6823	0.6925	0.9853
1.05	0.198163	0.8243	0.7984	0.6581	0.6991	0.9414
1.55	0.138049	0.7978	0.8068	0.6436	0.7088	0.9080
1.65	0.104669	0.8213	0.8094	0.6648	0.7002	0.9494
1.95	0.082409	0.8243	0.8057	0.6642	0.6991	0.9500
2.25	0.056221	0.8346	0.8059	0.6727	0.6954	0.9673
2.55	0.041598	0.8292	0.7959	0.6600	0.6974	0.9463
2.85	0.027825	0.8558	0.7895	0.6757	0.6877	0.9825
3.15	0.019495	0.8352	0.7894	0.6594	0.6952	0.9485
3.45	0.012913	0.8407	0.7994	0.6720	0.6932	0.9695
3.75	0.009020	0.8346	0.7915	0.6606	0.6954	0.9499
4.05	0.005211	0.8401	0.8007	0.6727	0.6934	0.9701
4.55	0.003546	0.8395	0.8027	0.6739	0.6936	0.9715
4.65	0.002850	0.8600	0.7772	0.6684	0.6861	0.9742
4.95	0.003009	0.6400	0.8631	0.5524	0.7664	0.7207

Rep. 2, Time: 1896000 s, C0: 3451 cpm/g
Average Bulk Density................0.8276 g/cc
Average Gravimetric Water Content...0.8012 g/g
Average Volumetric Water Content....0.6629 cc/cc
Average Porosity....................0.6980 cc/cc
Average Saturation..................0.9528 cc/cc

75% BENTONITE

Med Bulk Density

X	C / C0	Bulk Density	Water Content		Porosity	Saturation
(cm)		(g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	(cc/cc)	(cc/cc)
-4.95	0.848818	1.5224	0.4248	0.6467	0.4444	1.4552
-4.65	0.967937	1.3350	0.4296	0.5735	0.5128	1.1185
-4.35	0.997188	1.2976	0.4355	0.5651	0.5264	1.0734
-4.05	1.024433	1.2565	0.4358	0.5475	0.5414	1.0113
-3.75	1.027680	1.2492	0.4340	0.5421	0.5441	0.9964
-3.45	1.004615	1.2510	0.4353	0.5445	0.5434	1.0020
-3.15	0.983747	1.2450	0.4383	0.5457	0.5456	1.0002
-2.85	1.005528	1.2583	0.4376	0.5506	0.5408	1.0181
-2.55	1.009072	1.2087	0.4850	0.5862	0.5589	1.0490
-2.25	0.937114	1.2655	0.4317	0.5463	0.5381	1.0153
-1.95	0.942268	1.2371	0.4402	0.5445	0.5485	0.9928
-1.65	0.878253	1.2389	0.4429	0.5488	0.5478	1.0017
-1.35	0.827524	1.2293	0.4410	0.5421	0.5514	0.9832
-1.05	0.796549	1.2305	0.4420	0.5439	0.5509	0.9873
-0.75	0.700552	1.2426	0.4387	0.5451	0.5465	0.9975
-0.45	0.636091	1.2226	0.4390	0.5367	0.5538	0.9691
-0.15	0.643184	0.9337	0.4278	0.3995	0.6592	0.6060
0.15	0.478162	1.0866	0.4249	0.4617	0.6034	0.7652
0.45	0.361119	1.2099	0.4371	0.5288	0.5584	0.9470
0.75	0.280899	1.2432	0.4404	0.5475	0.5463	1.0023
1.05	0.210902	1.2238	0.4435	0.5427	0.5533	0.9808
1.35	0.152354	1.2401	0.4444	0.5512	0.5474	1.0069
1.65	0.101226	1.2166	0.4451	0.5415	0.5560	0.9739
1.95	0.072747	1.2522	0.4377	0.5481	0.5430	1.0095
2.25	0.047426	1.2450	0.4398	0.5475	0.5456	1.0035
2.55	0.036095	1.2619	0.4349	0.5488	0.5395	1.0172
2.85	0.018915	1.2486	0.4376	0.5463	0.5443	1.0037
3.15	0.010588	1.2746	0.4339	0.5530	0.5348	1.0340
3.45	0.008320	1.2166	0.4342	0.5282	0.5560	0.9500
3.75	0.004016	1.2601	0.4364	0.5500	0.5401	1.0182
4.05	0.0	1.2474	0.4360	0.5439	0.5447	0.9985
4.35	0.0	1.2667	0.4351	0.5512	0.5377	1.0251
4.65	0.0	1.3532	0.4301	0.5820	0.5061	1.1498
4.95	0.0	1.3260	0.4312	0.5717	0.5161	1.1078

Rep. 1, Time: 2412900 s, C0: 358 cpm/g
Average Bulk Density................1.2469 g/cc
Average Gravimetric Water Content...0.4377 g/g
Average Volumetric Water Content....0.5457 cc/cc
Average Porosity....................0.5449 cc/cc
Average Saturation..................1.0079 cc/cc

75% BENTONITE

Med Bulk Density

Water Content

X (cm)	C / C0	Bulk Density (g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.95	0.870363	1.5254	0.4255	0.6491	0.4433	1.4642
-4.65	1.028258	1.2438	0.4295	0.5343	0.5461	0.9784
-4.35	0.979615	1.2438	0.4315	0.5367	0.5461	0.9828
-4.05	1.020524	1.2268	0.4330	0.5312	0.5522	0.9619
-3.75	0.997003	1.2389	0.4322	0.5355	0.5478	0.9774
-3.45	0.978364	1.2522	0.4300	0.5385	0.5430	0.9917
-3.15	0.971638	1.2401	0.4352	0.5397	0.5474	0.9859
-2.85	1.029141	1.2166	0.4372	0.5318	0.5560	0.9565
-2.55	0.978967	1.2377	0.4365	0.5403	0.5483	0.9854
-2.25	0.978816	1.2414	0.4343	0.5391	0.5470	0.9856
-1.95	0.934662	1.2299	0.4349	0.5349	0.5511	0.9704
-1.65	0.841455	1.2323	0.4389	0.5409	0.5503	0.9830
-1.35	0.841294	1.2365	0.4335	0.5361	0.5487	0.9769
-1.05	0.806611	1.2293	0.4376	0.5379	0.5514	0.9755
-0.75	0.747870	1.2202	0.4334	0.5288	0.5547	0.9534
-0.45	0.643922	1.2293	0.4312	0.5300	0.5514	0.9613
-0.15	0.577283	1.0975	0.4268	0.4684	0.5994	0.7813
0.15	0.477404	1.0244	0.4236	0.4339	0.6261	0.6930
0.45	0.371046	1.2093	0.4288	0.5185	0.5586	0.9282
0.75	0.285628	1.2238	0.4370	0.5349	0.5533	0.9666
1.05	0.219855	1.2383	0.4402	0.5451	0.5481	0.9947
1.35	0.161720	1.2262	0.4416	0.5415	0.5525	0.9802
1.65	0.115865	1.2184	0.4415	0.5379	0.5553	0.9686
1.95	0.076409	1.2317	0.4406	0.5427	0.5505	0.9859
2.25	0.052902	1.2389	0.4380	0.5427	0.5478	0.9907
2.55	0.031336	1.2335	0.4390	0.5415	0.5498	0.9849
2.85	0.019215	1.2244	0.4427	0.5421	0.5531	0.9801
3.15	0.013558	1.2395	0.4369	0.5415	0.5476	0.9888
3.45	0.0	1.2293	0.4390	0.5397	0.5514	0.9788
3.75	0.004048	1.2456	0.4381	0.5457	0.5454	1.0006
4.05	0.003882	1.2988	0.4351	0.5651	0.5260	1.0743
4.35	0.005407	1.2432	0.4366	0.5427	0.5463	0.9935
4.65	0.006822	1.2317	0.4342	0.5349	0.5505	0.9716
4.95	0.001142	1.4716	0.4267	0.6279	0.4629	1.3564

Rep. 2, Time: 2414700 s, C0: 359 cpm/g
Average Bulk Density................1.2403 g/cc
Average Gravimetric Water Content...0.4347 g/g
Average Volumetric Water Content....0.5392 cc/cc
Average Porosity....................0.5473 cc/cc
Average Saturation..................0.9914 cc/cc

100% BENTONITE

Low Bulk Density

Water Content

X (cm)	C / C0	Bulk Density (g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.95	0.970270	0.5717	1.4366	0.8213	0.7936	1.0349
-4.65	1.029760	0.5137	1.4447	0.7422	0.8145	0.9111
-4.35	0.969218	0.5584	1.4437	0.8062	0.7984	1.0098
-4.05	1.030756	0.5463	1.4502	0.7923	0.8028	0.9870
-3.75	0.954743	0.5300	1.4447	0.7657	0.8087	0.9469
-3.45	0.975219	0.5433	1.4516	0.7887	0.8039	0.9811
-3.15	1.008533	0.5137	1.4553	0.7476	0.8145	0.9178
-2.85	1.055513	0.5270	1.4587	0.7687	0.8097	0.9494
-2.55	0.939507	0.5355	1.4628	0.7832	0.8067	0.9709
-2.25	0.959605	0.5210	1.4594	0.7603	0.8119	0.9364
-1.95	0.859523	0.5379	1.4562	0.7832	0.8058	0.9720
-1.65	0.870367	0.5270	1.4622	0.7706	0.8097	0.9516
-1.35	0.795444	0.5451	1.4457	0.7881	0.8032	0.9812
-1.05	0.742481	0.5240	1.4348	0.7518	0.8108	0.9272
-0.75	0.688142	0.5373	1.4319	0.7693	0.8060	0.9545
-0.45	0.679438	0.4648	1.4226	0.6612	0.8322	0.7945
-0.15	0.468232	0.6509	1.3918	0.9059	0.7650	1.1842
0.15	0.365503	0.6509	1.4150	0.9210	0.7650	1.2039
0.45	0.382668	0.4660	2.7302	1.2722	0.8318	1.5295
0.75	0.290836	0.5614	1.4263	0.8008	0.7973	1.0043
1.05	0.237785	0.5270	1.4312	0.7542	0.8097	0.9314
1.35	0.191679	0.5385	1.4321	0.7712	0.8056	0.9572
1.65	0.147804	0.5113	1.4409	0.7367	0.8154	0.9035
1.95	0.116154	0.5518	1.4480	0.7990	0.8008	0.9977
2.25	0.087383	0.5397	1.4490	0.7820	0.8052	0.9713
2.55	0.065709	0.5270	1.4415	0.7597	0.8097	0.9382
2.85	0.049382	0.5191	1.4459	0.7506	0.8126	0.9237
3.15	0.034979	0.5469	1.4564	0.7965	0.8025	0.9925
3.45	0.022861	0.5482	1.4542	0.7971	0.8021	0.9938
3.75	0.016810	0.5065	1.4630	0.7409	0.8172	0.9067
4.05	0.011455	0.5512	1.4704	0.8104	0.8010	1.0118
4.35	0.008472	0.4968	1.4647	0.7276	0.8207	0.8867
4.65	0.006538	0.5560	1.4565	0.8098	0.7993	1.0132
4.95	0.006049	0.4744	1.4420	0.6841	0.8287	0.8255

Rep. 1, Time: 1809000 s, C0: 6317 cpm/g
Average Bulk Density................0.5359 g/cc
Average Gravimetric Water Content...1.4829 g/g
Average Volumetric Water Content....0.7918 cc/cc
Average Porosity....................0.8065 cc/cc
Average Saturation..................0.9824 cc/cc

100% BENTONITE

Low Bulk Density

			Water Content			
X (cm)	C / CO	Bulk Density (g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.95	1.100236	0.4321	1.3860	0.5989	0.8440	0.7096
-4.65	1.071461	0.5814	1.4002	0.8141	0.7901	1.0303
-4.35	0.996676	0.5469	1.4022	0.7669	0.8025	0.9556
-4.05	1.123352	0.5288	1.4023	0.7415	0.8091	0.9165
-3.75	1.019769	0.5820	1.4008	0.8153	0.7899	1.0321
-3.45	0.996095	0.5512	1.4079	0.7760	0.8010	0.9688
-3.15	1.001390	0.5645	1.4111	0.7965	0.7962	1.0004
-2.85	0.906170	0.5409	1.4089	0.7621	0.8047	0.9470
-2.55	1.027682	0.5578	1.4117	0.7875	0.7986	0.9860
-2.25	0.600651	0.9742	0.8120	0.7911	0.6483	1.2203
-1.95	0.967231	0.5512	1.4079	0.7760	0.8010	0.9688
-1.65	0.885278	0.5578	1.3998	0.7808	0.7986	0.9777
-1.35	0.815562	0.5560	1.3935	0.7748	0.7993	0.9694
-1.05	0.765493	0.5433	1.4082	0.7651	0.8039	0.9518
-0.75	0.707120	0.5427	1.4098	0.7651	0.8041	0.9515
-0.45	0.689470	0.5729	1.4124	0.8092	0.7932	1.0203
-0.15	0.470641	0.5657	1.4145	0.8002	0.7958	1.0055
0.15	0.409756	0.6249	1.4072	0.8793	0.7744	1.1355
0.45	0.398790	0.5379	1.4056	0.7561	0.8058	0.9382
0.75	0.323283	0.5463	1.4060	0.7681	0.8028	0.9569
1.05	0.237982	0.5530	1.4076	0.7784	0.8004	0.9726
1.35	0.188877	0.5409	1.4156	0.7657	0.8047	0.9515
1.65	0.157294	0.5367	1.4189	0.7615	0.8063	0.9445
1.95	0.125196	0.5584	1.4210	0.7935	0.7984	0.9939
2.25	0.090122	0.5548	1.4150	0.7851	0.7997	0.9817
2.55	0.066474	0.5584	1.4102	0.7875	0.7984	0.9863
2.85	0.050148	0.5633	1.4099	0.7941	0.7967	0.9968
3.15	0.036874	0.5518	1.4064	0.7760	0.8008	0.9690
3.45	0.026295	0.5639	1.4051	0.7923	0.7964	0.9948
3.75	0.017485	0.5385	1.4130	0.7609	0.8056	0.9445
4.05	0.011704	0.5548	1.4107	0.7826	0.7997	0.9787
4.35	0.009012	0.5524	1.4114	0.7796	0.8006	0.9738
4.65	0.008379	0.5554	1.3983	0.7766	0.7995	0.9714
4.95	0.007461	0.3916	1.3750	0.5385	0.8586	0.6271

```
Rep. 2,  Time:  1802990 s, CO:    5584 cpm/g
Average Bulk Density................0.5598 g/cc
Average Gravimetric Water Content...1.3890 g/g
Average Volumetric Water Content....0.7705 cc/cc
Average Porosity.............       0.7979 cc/cc
Average Saturation..................0.9685 cc/cc
```

100% BENTONITE

Med Bulk Density

Water Content

X (cm)	C / C0	Bulk Density (g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.95	0.958432	1.2601	0.5391	0.6793	0.5451	1.2462
-4.65	1.002131	1.1761	0.5421	0.6376	0.5754	1.1081
-4.35	0.996759	1.1132	0.5478	0.6098	0.5981	1.0195
-4.05	1.010973	1.0794	0.5482	0.5917	0.6103	0.9694
-3.75	0.989844	1.0993	0.5470	0.6013	0.6031	0.9970
-3.45	1.035549	1.0715	0.5460	0.5850	0.6132	0.9541
-3.15	1.011294	1.0927	0.5481	0.5989	0.6055	0.9891
-2.85	0.995157	1.0842	0.5474	0.5935	0.6086	0.9752
-2.55	1.001822	1.0739	0.5470	0.5874	0.6123	0.9594
-2.25	0.933052	1.1005	0.5475	0.6025	0.6027	0.9998
-1.95	0.957044	1.0745	0.5495	0.5905	0.6121	0.9647
-1.65	0.866592	1.0806	0.5515	0.5959	0.6099	0.9770
-1.35	0.841520	1.0764	0.5519	0.5941	0.6114	0.9716
-1.05	0.774795	1.0721	0.5496	0.5892	0.6129	0.9613
-0.75	0.712346	1.0758	0.5478	0.5892	0.6116	0.9634
-0.45	0.660256	1.0794	0.5454	0.5886	0.6103	0.9645
-0.15	0.584857	0.9748	0.5356	0.5222	0.6481	0.8057
0.15	0.447145	0.9597	0.5296	0.5083	0.6535	0.7777
0.45	0.330090	1.0679	0.5473	0.5844	0.6145	0.9511
0.75	0.291058	1.0637	0.5540	0.5892	0.6160	0.9566
1.05	0.203105	1.0715	0.5533	0.5929	0.6132	0.9669
1.35	0.151337	1.0836	0.5527	0.5989	0.6088	0.9838
1.65	0.099393	1.0794	0.5521	0.5959	0.6103	0.9764
1.95	0.068424	1.0752	0.5531	0.5947	0.6119	0.9719
2.25	0.046831	1.0800	0.5518	0.5959	0.6101	0.9767
2.55	0.028177	1.0878	0.5522	0.6007	0.6073	0.9892
2.85	0.015672	1.0758	0.5528	0.5947	0.6116	0.9723
3.15	0.006998	1.0951	0.5497	0.6019	0.6047	0.9955
3.45	0.008539	1.0770	0.5494	0.5917	0.6112	0.9680
3.75	0.001410	1.0872	0.5475	0.5953	0.6075	0.9799
4.05	0.002805	1.0927	0.5498	0.6007	0.6055	0.9921
4.35	0.0	1.1144	0.5499	0.6128	0.5977	1.0253
4.65	0.0	1.1586	0.5462	0.6328	0.5817	1.0877
4.95	0.0	1.1737	0.5386	0.6322	0.5763	1.0969

Rep. 1, Time: 2330100 s, C0: 394 cpm/g
Average Bulk Density.................1.0890 g/cc
Average Gravimetric Water Content...0.5477 g/g
Average Volumetric Water Content....0.5965 cc/cc
Average Porosity....................0.6068 cc/cc
Average Saturation..................0.9851 cc/cc

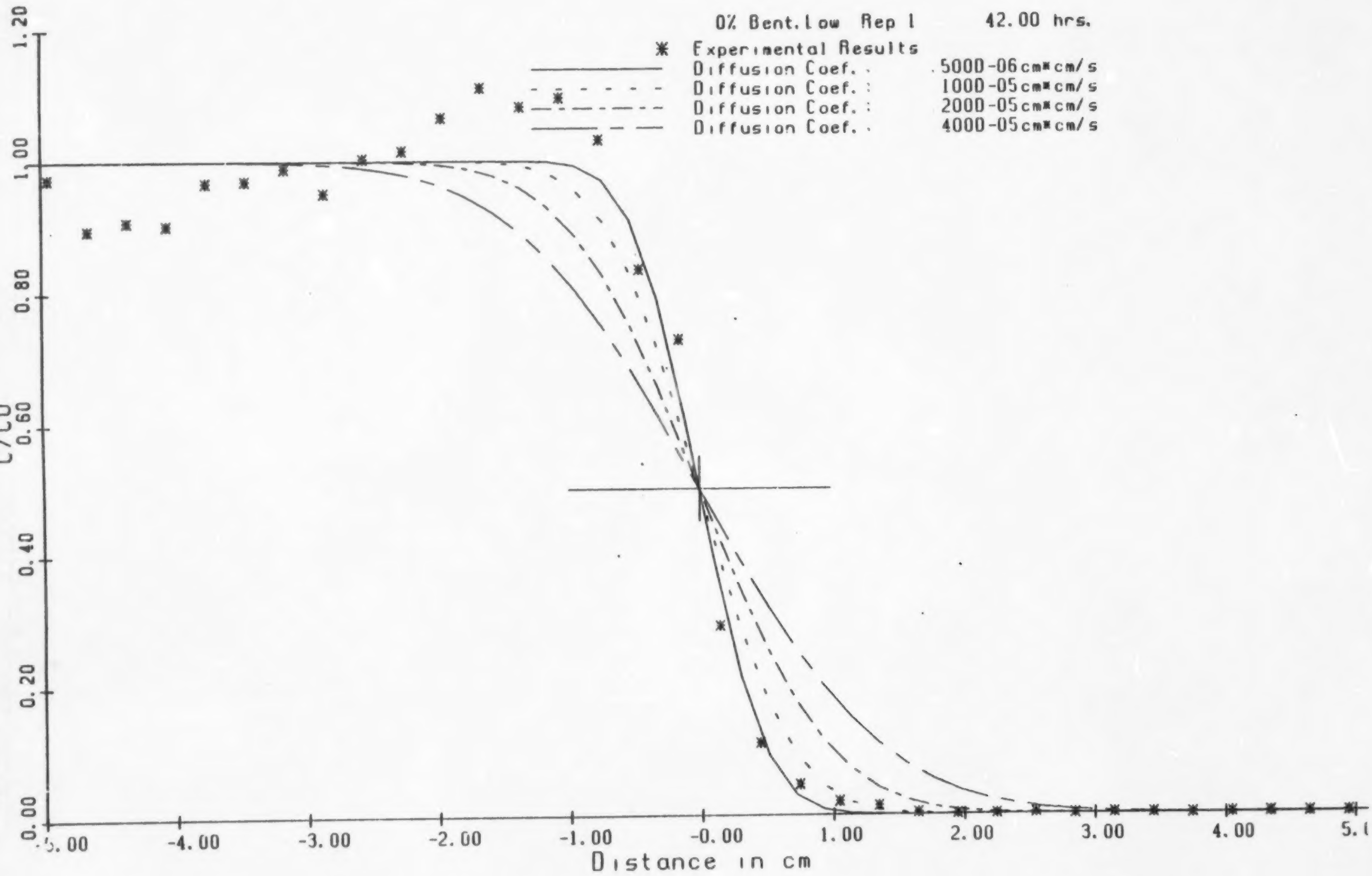
100% BENTONITE

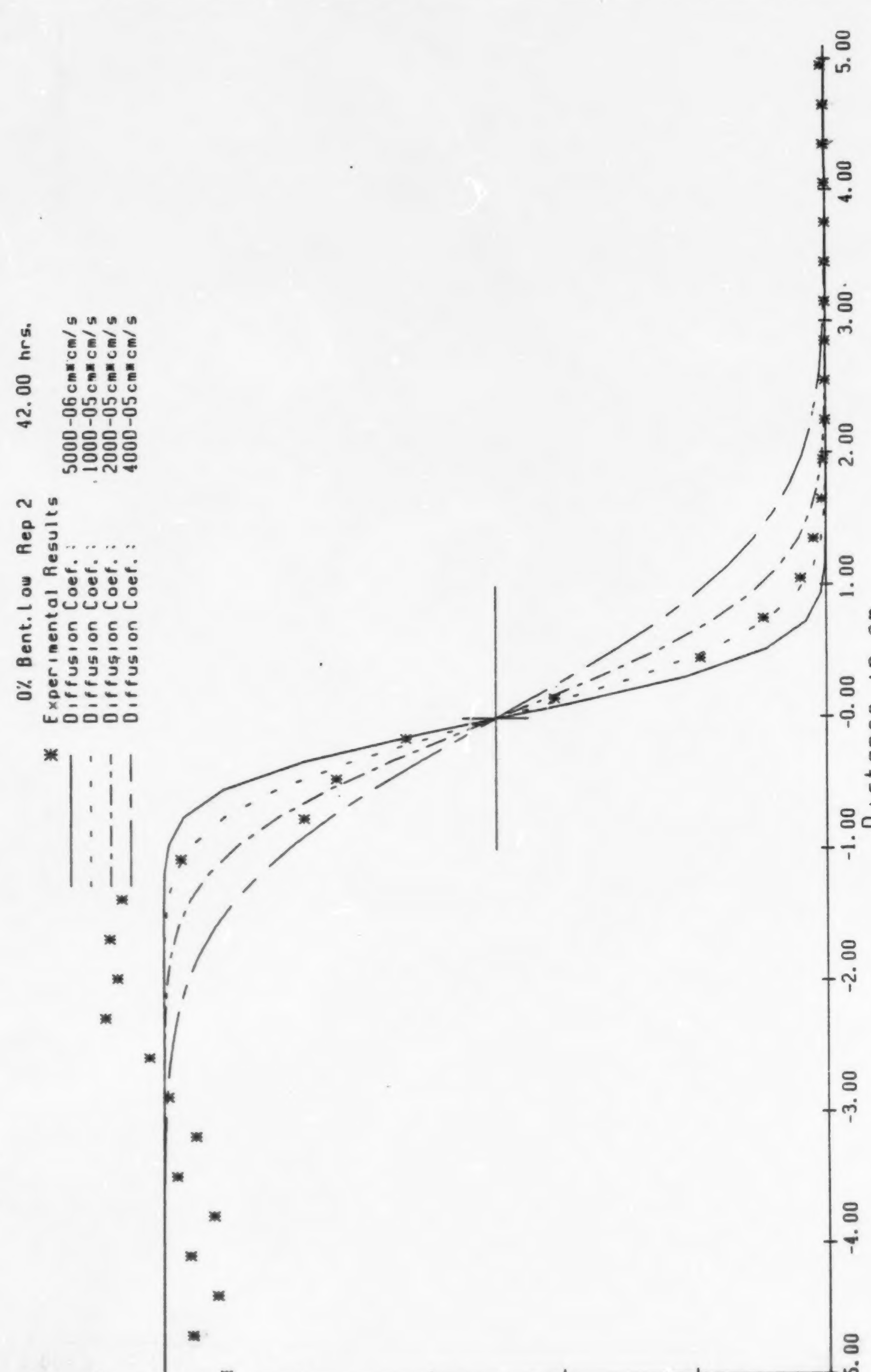
Med Bulk Density

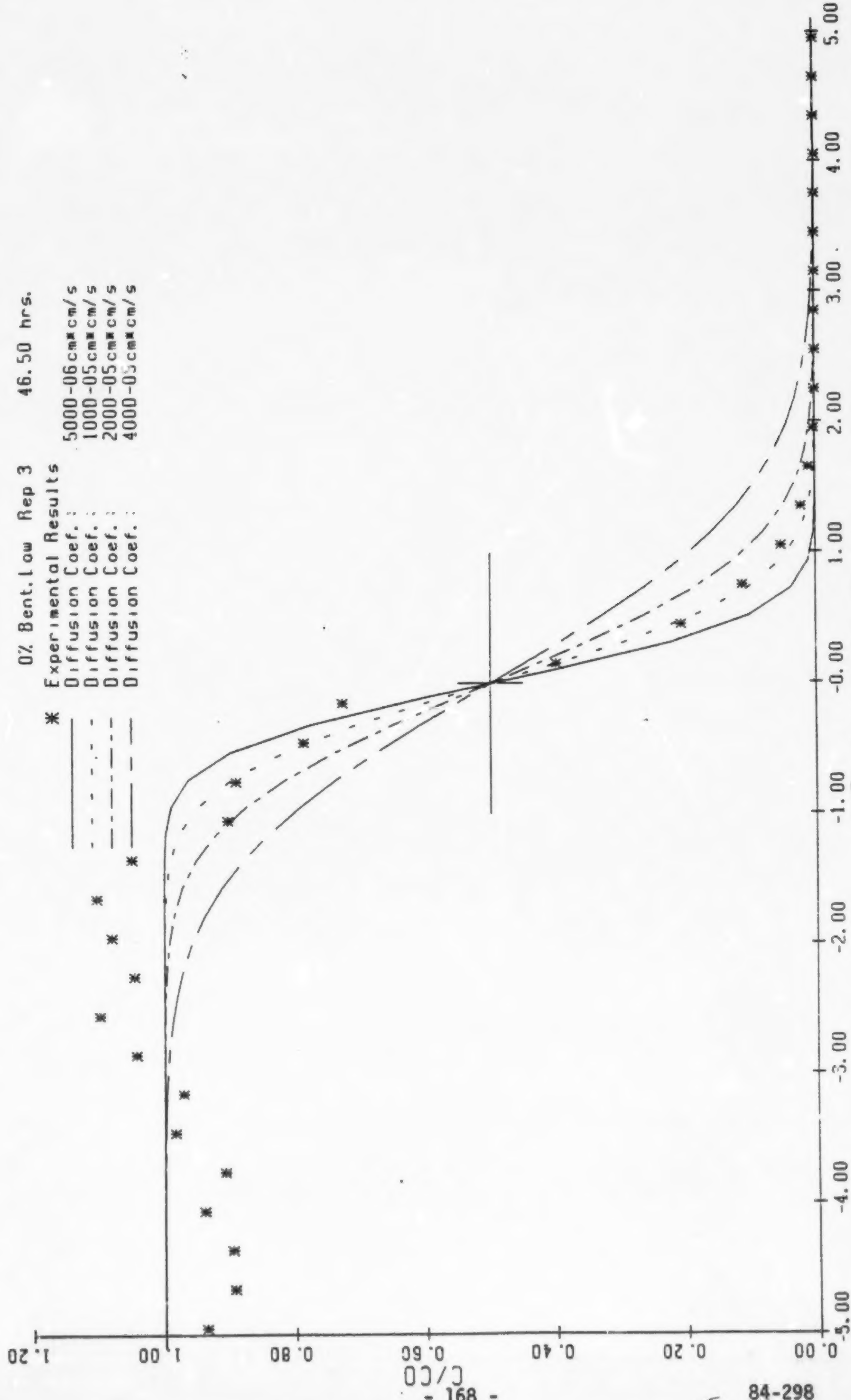
Water Content

X (cm)	C / C0	Bulk Density (g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.95	0.895099	1.3109	0.5408	0.7089	0.5268	1.3458
-4.65	0.997948	1.1604	0.5422	0.6291	0.5811	1.0827
-4.35	1.002563	1.1259	0.5437	0.6122	0.5935	1.0315
-4.05	0.984178	1.1126	0.5443	0.6056	0.5983	1.0121
-3.75	1.018979	1.1048	0.5449	0.6019	0.6012	1.0013
-3.45	0.989405	1.1005	0.5442	0.5989	0.6027	0.9937
-3.15	1.028413	1.1066	0.5451	0.6031	0.6005	1.0044
-2.85	0.970197	1.1017	0.5464	0.6019	0.6023	0.9995
-2.55	1.020631	1.1090	0.5439	0.6031	0.5996	1.0059
-2.25	0.958940	1.1211	0.5439	0.6098	0.5953	1.0244
-1.95	0.932005	1.0909	0.5457	0.5953	0.6062	0.9820
-1.65	0.888647	1.0957	0.5472	0.5995	0.6044	0.9919
-1.35	0.848923	1.1017	0.5469	0.6025	0.6023	1.0005
-1.05	0.810215	1.0975	0.5435	0.5965	0.6038	0.9879
-0.75	0.723070	1.1023	0.5411	0.5965	0.6020	0.9908
-0.45	0.654378	1.0866	0.5328	0.5790	0.6077	0.9527
-0.15	0.598935	0.8975	0.5273	0.4732	0.6760	0.7000
0.15	0.447696	0.9640	0.5292	0.5101	0.6520	0.7823
0.45	0.336250	1.0733	0.5411	0.5808	0.6125	0.9482
0.75	0.266896	1.0818	0.5497	0.5947	0.6095	0.9758
1.05	0.202898	1.0824	0.5505	0.5959	0.6092	0.9781
1.35	0.153101	1.0733	0.5512	0.5917	0.6125	0.9660
1.65	0.112216	1.0812	0.5511	0.5959	0.6097	0.9774
1.95	0.073168	1.0915	0.5515	0.6019	0.6060	0.9934
2.25	0.043741	1.0884	0.5519	0.6007	0.6071	0.9896
2.55	0.029997	1.0752	0.5526	0.5941	0.6119	0.9709
2.85	0.019853	1.0830	0.5502	0.5959	0.6090	0.9784
3.15	0.008419	1.0945	0.5494	0.6013	0.6049	0.9941
3.45	0.001207	1.2728	0.5480	0.6974	0.5405	1.2903
3.75	0.0	0.9029	0.5489	0.4956	0.6740	0.7352
4.05	0.006958	1.1036	0.5515	0.6086	0.6016	1.0116
4.35	0.0	1.1235	0.5476	0.6152	0.5944	1.0350
4.65	0.0	1.1368	0.5439	0.6183	0.5896	1.0486
4.95	0.001333	1.1519	0.5430	0.6255	0.5841	1.0708

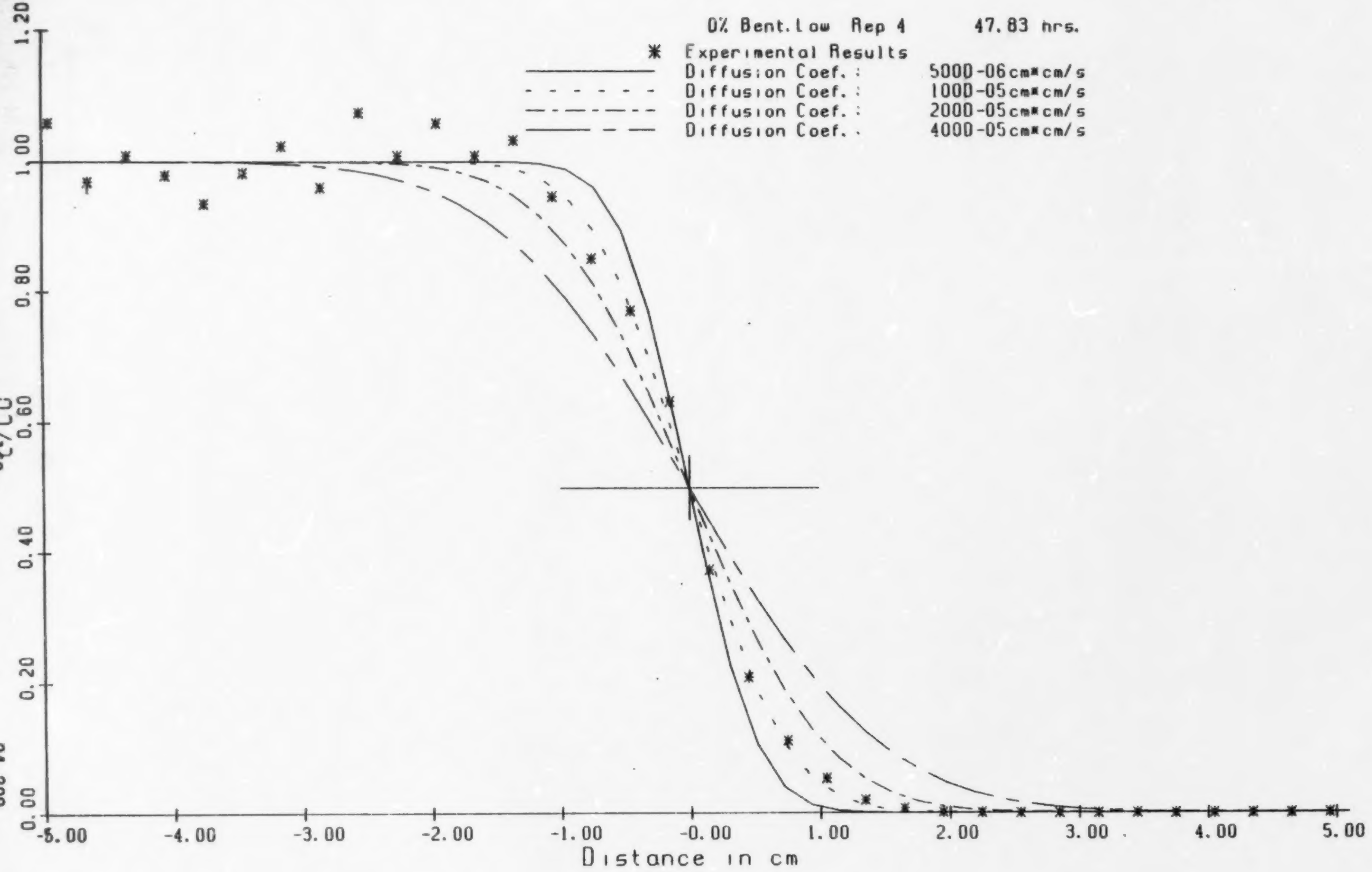
Rep. 2, Time: 2330100 s, C0: 393 cpm/g
Average Bulk Density................1.0972 g/cc
Average Gravimetric Water Content...0.5451 g/g
Average Volumetric Water Content....0.5983 cc/cc
Average Porosity....................0.6039 cc/cc
Average Saturation..................0.9957 cc/cc

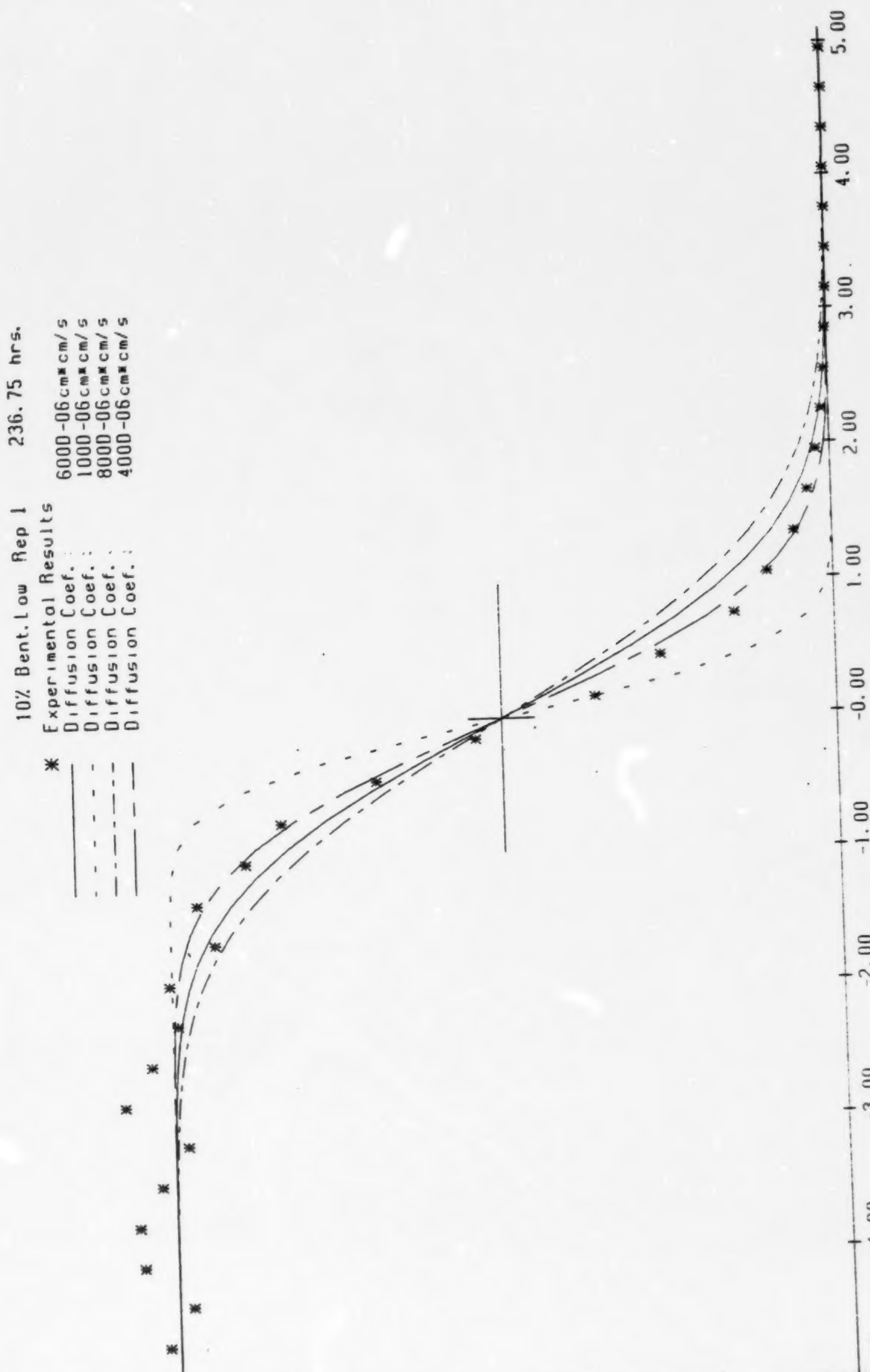

0% Bent.Low Rep 1 42.00 hrs.
Experimental Results
Diffusion Coef. .5000-06cm*cm/s
Diffusion Coef. 1000-05cm*cm/s
Diffusion Coef. 2000-05cm*cm/s
Diffusion Coef. 4000-05cm*cm/s
C/C0
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.
Distance in cm

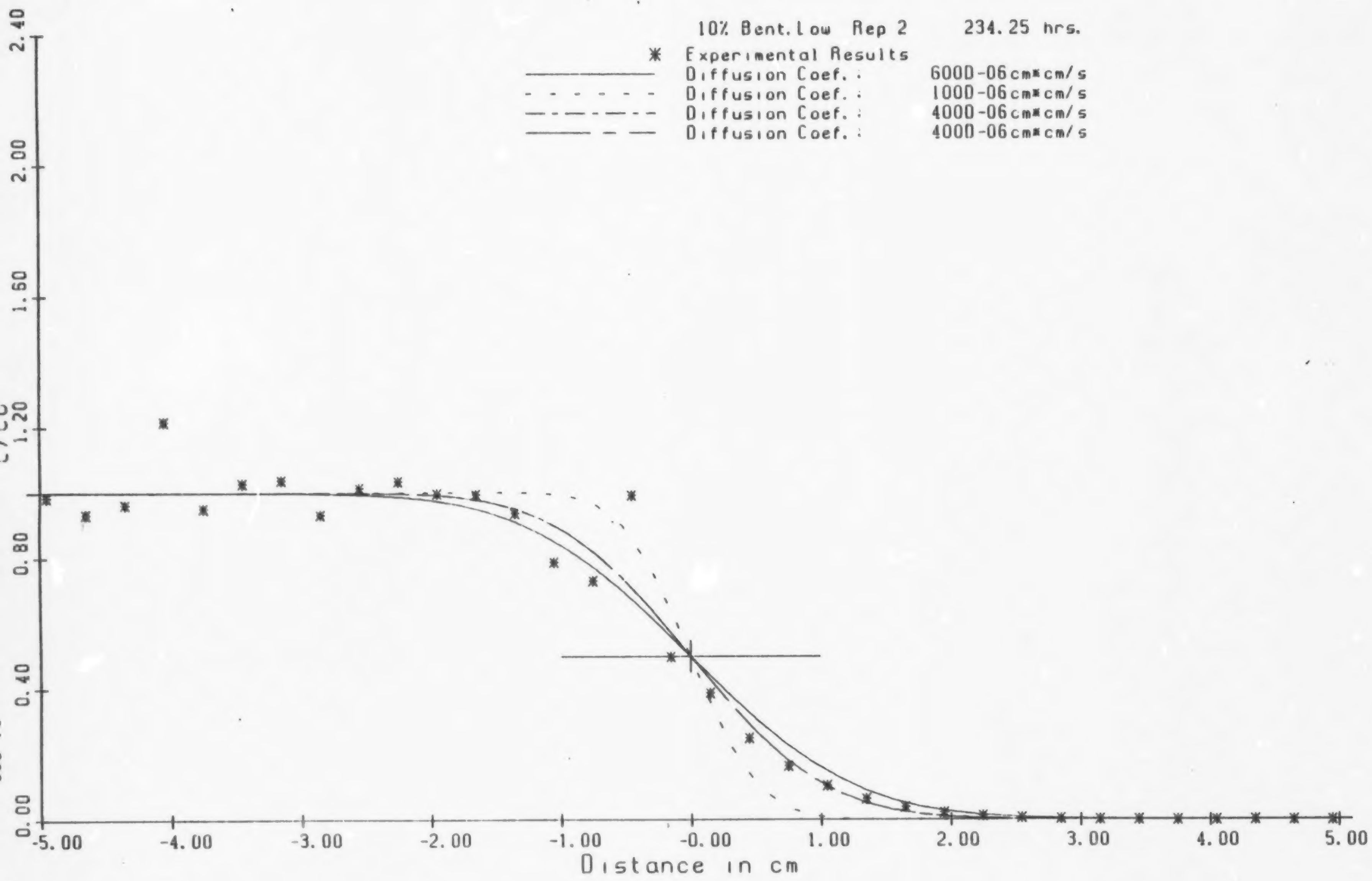

0% Bent.Low Rep 2
42.00 hrs.
Experimental Results
Diffusion Coef. : 5000-06cm*cm/s
Diffusion Coef. : 1000-05cm*cm/s
Diffusion Coef. : 2000-05cm*cm/s
Diffusion Coef. : 4000-05cm*cm/s
C/CO
0.00
0.20
0.40
0.60
0.80
1.00
1.20
Distance in cm
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00

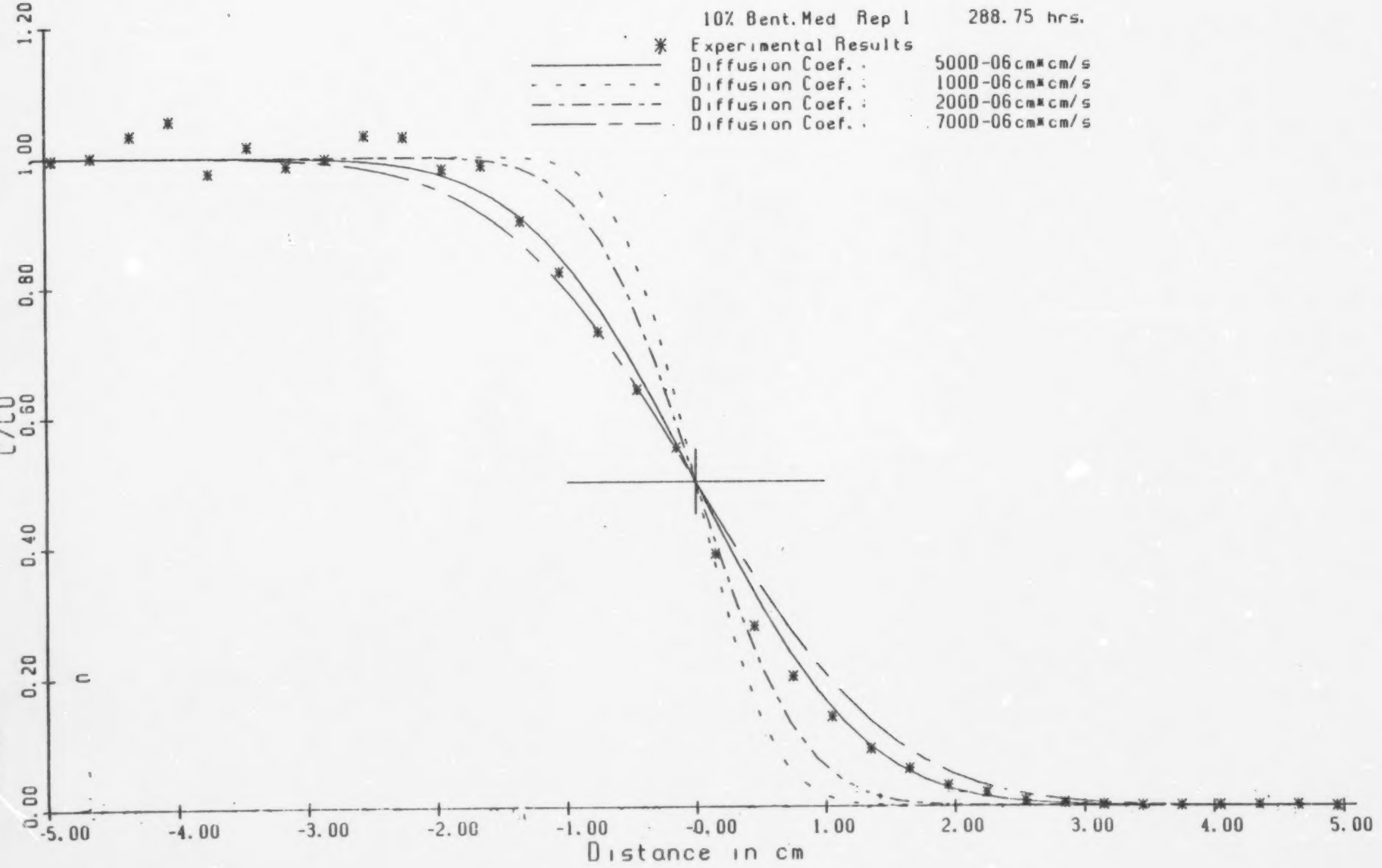


0% Bent.Low Rep 3
46.50 hrs.
Experimental Results
Diffusion Coef. : 5000-06cm*cm/s
Diffusion Coef. : 1000-05cm*cm/s
Diffusion Coef. : 2000-05cm*cm/s
Diffusion Coef. : 4000-05cm*cm/s
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
Distance in cm
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00

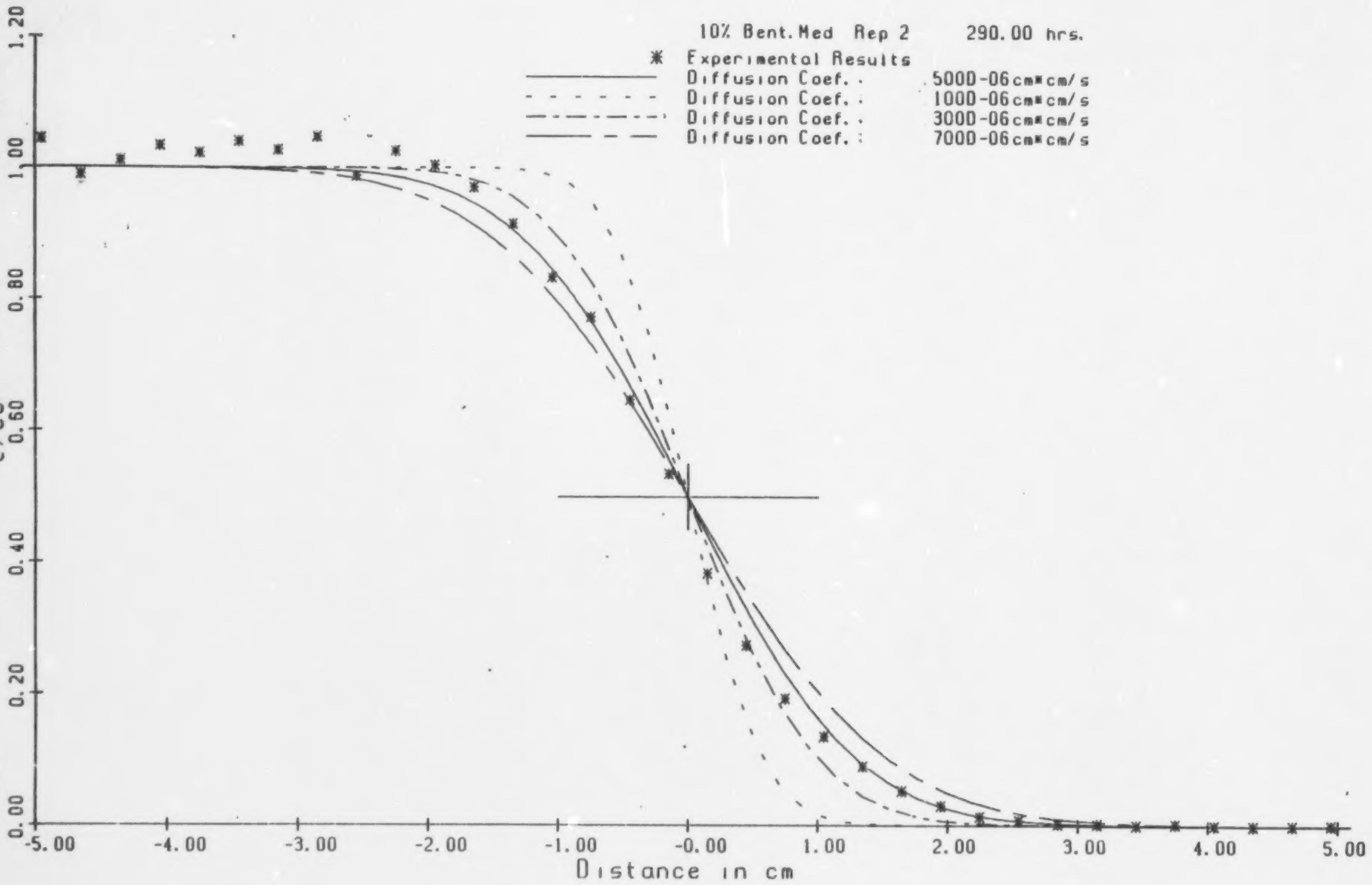

0% Bent.Low Rep 4 47.83 hrs.
Experimental Results
Diffusion Coef.: 5000-06cm*cm/s
Diffusion Coef.: 1000-05cm*cm/s
Diffusion Coef.: 2000-05cm*cm/s
Diffusion Coef.: 4000-05cm*cm/s
C/C0
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

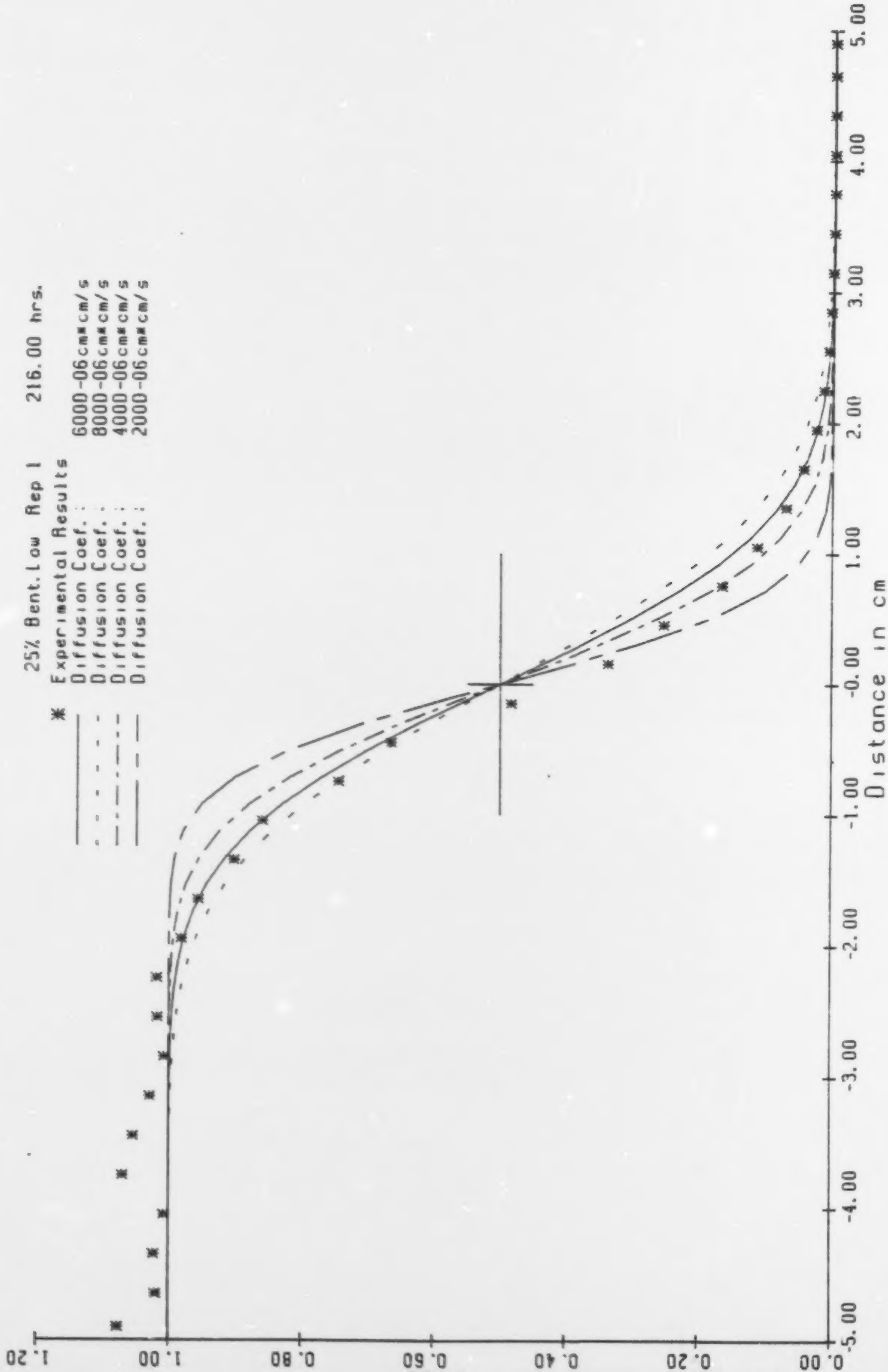

10% Bent.Low Rep 1 236.75 hrs.
Experimental Results
Diffusion Coef. : 6000-06cm*cm/s
Diffusion Coef. : 1000-06cm*cm/s
Diffusion Coef. : 8000-06cm*cm/s
Diffusion Coef. : 4000-06cm*cm/s
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
Distance in cm
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00

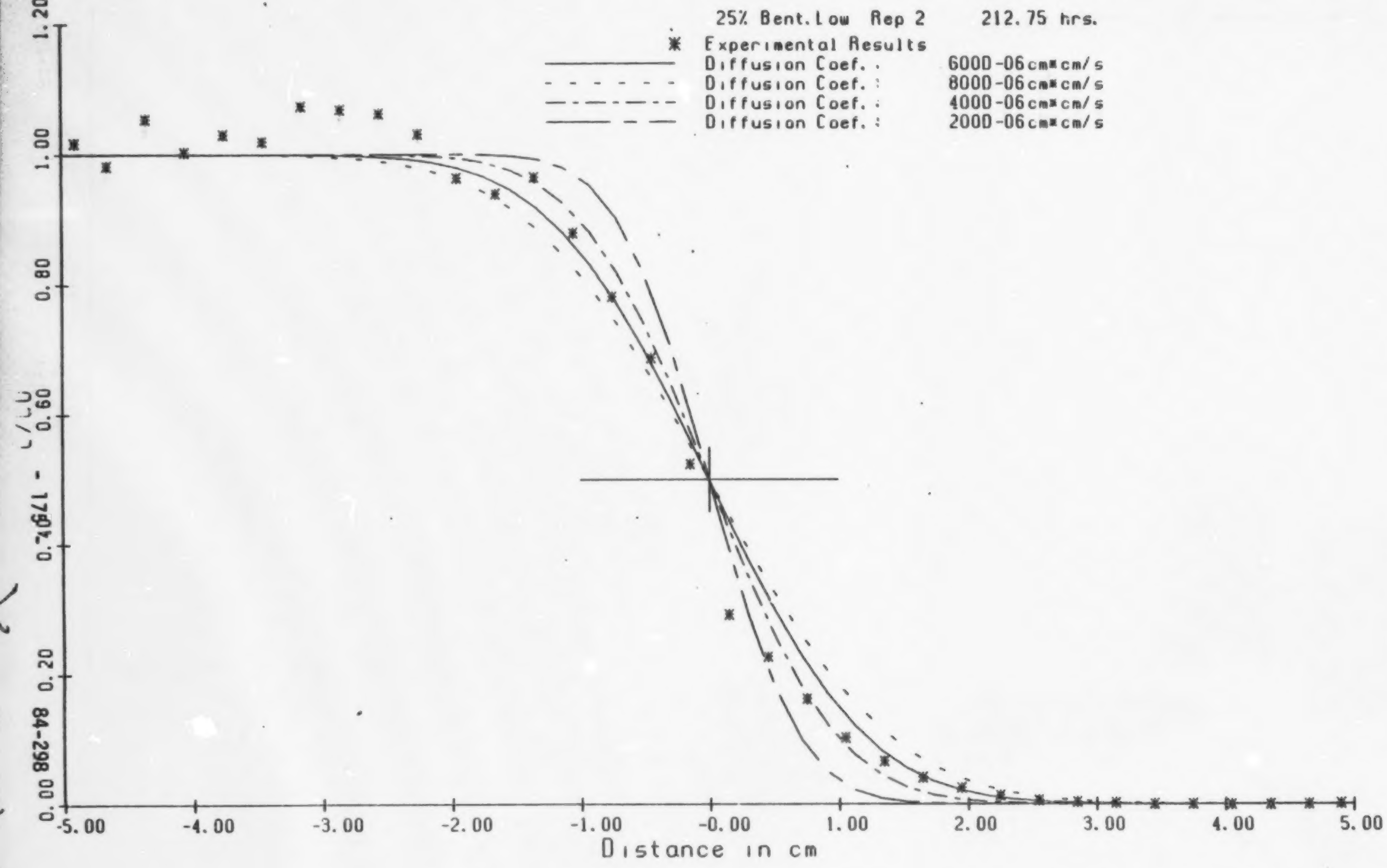

10% Bent.Low Rep 2 234.25 hrs.
✱ Experimental Results
Diffusion Coef.: 6000-06cm*cm/s
Diffusion Coef.: 1000-06cm*cm/s
Diffusion Coef.: 4000-06cm*cm/s
Diffusion Coef.: 4000-06cm*cm/s
2.40
2.00
1.60
1.20
0.80
0.40
0.00
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

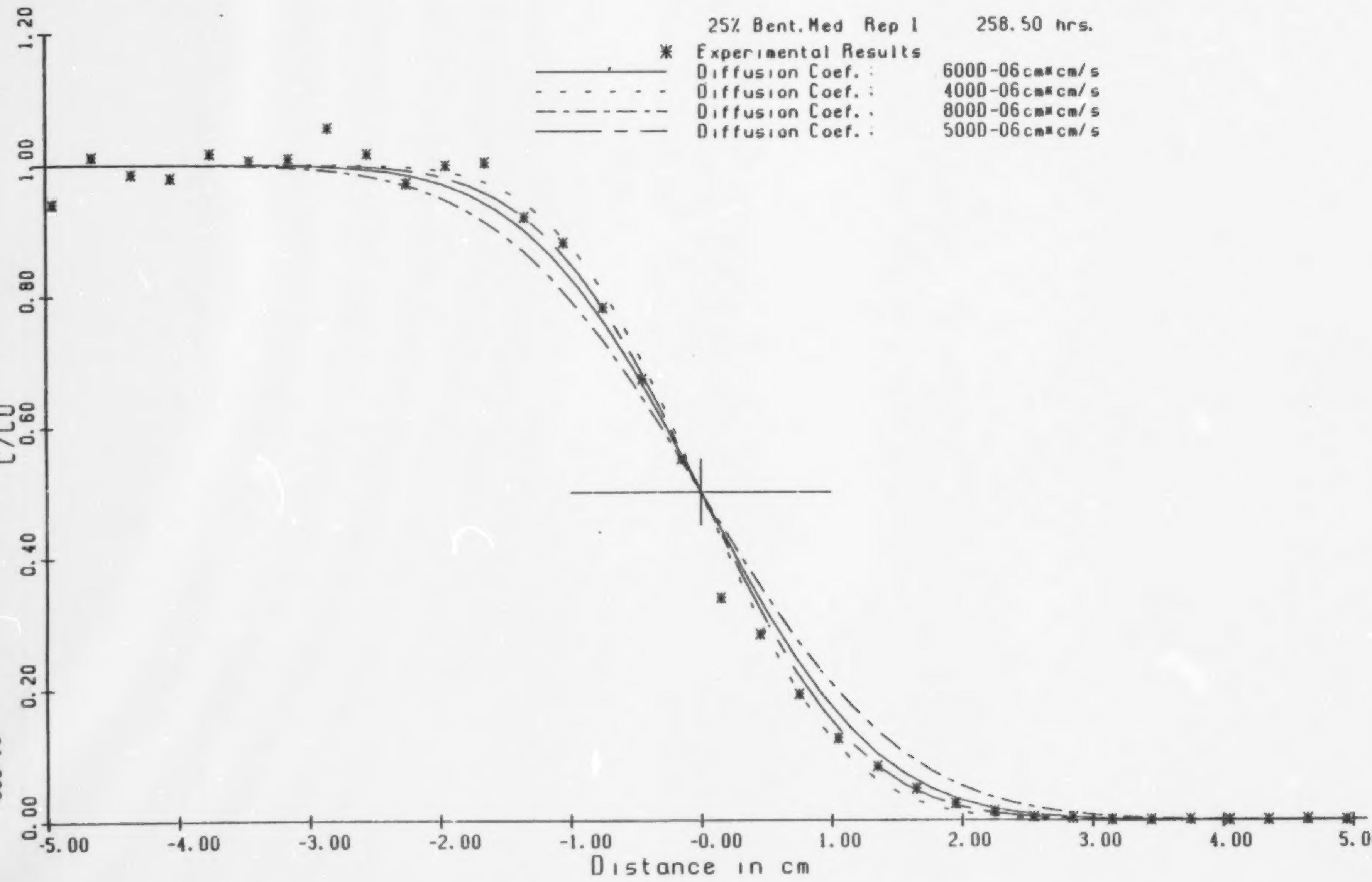


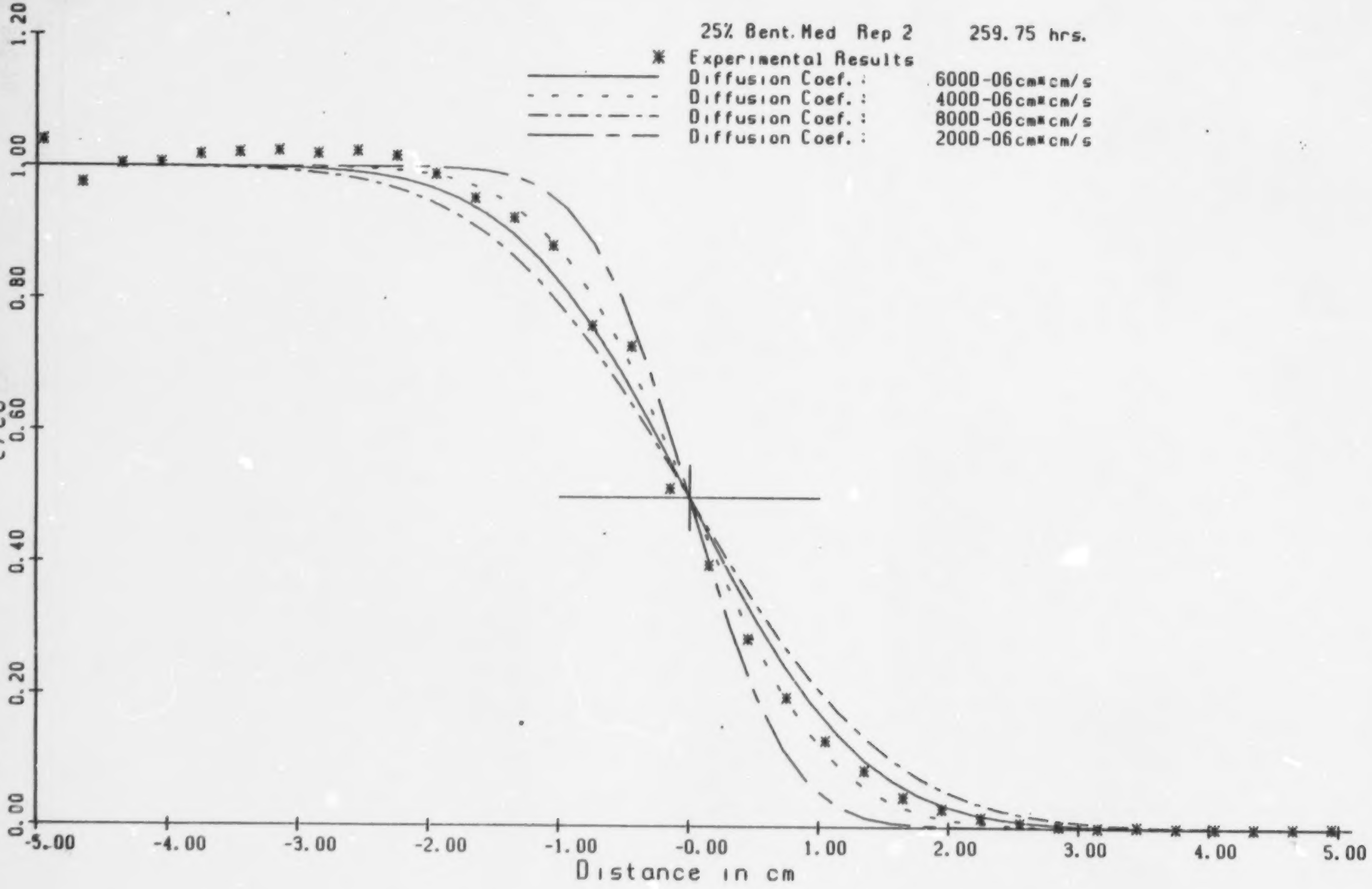
10% Bent.Med Rep 1 288.75 hrs.
Experimental Results
Diffusion Coef. : 5000-06cm*cm/s
Diffusion Coef. : 1000-06cm*cm/s
Diffusion Coef. : 2000-06cm*cm/s
Diffusion Coef. : 7000-06cm*cm/s
C/CO
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

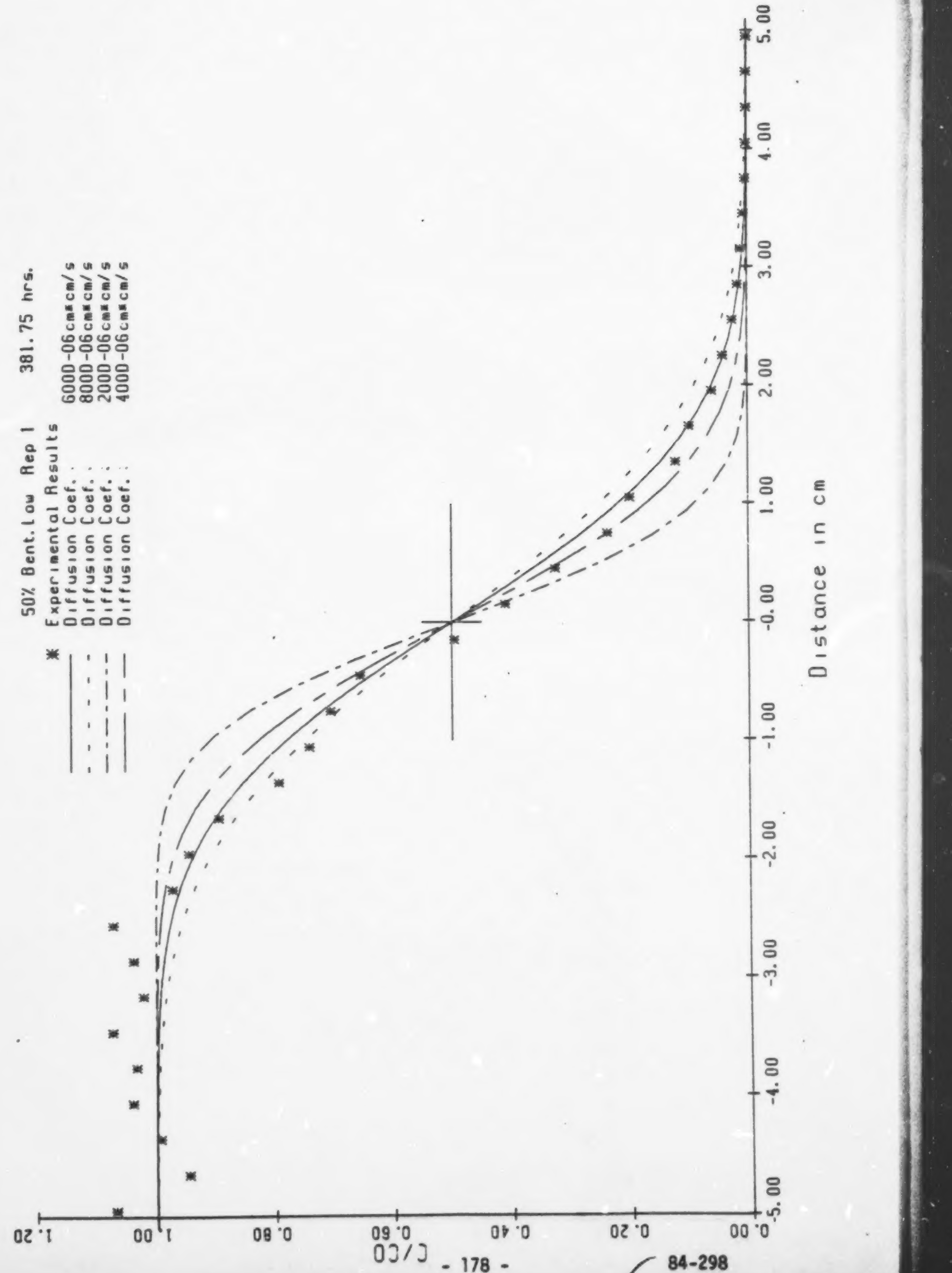

10% Bent.Med Rep 2 290.00 hrs.
Experimental Results
Diffusion Coef. . 5000-06cm*cm/s
Diffusion Coef. . 1000-06cm*cm/s
Diffusion Coef. . 3000-06cm*cm/s
Diffusion Coef. : 7000-06cm*cm/s
C/C0
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm


25% Bent.Law Rep 1 216.00 hrs.
* Experimental Results
Diffusion Coef. : 6000-06cm*cm/s
Diffusion Coef. : 8000-06cm*cm/s
Diffusion Coef. : 4000-06cm*cm/s
Diffusion Coef. : 2000-06cm*cm/s
Distance in cm
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20

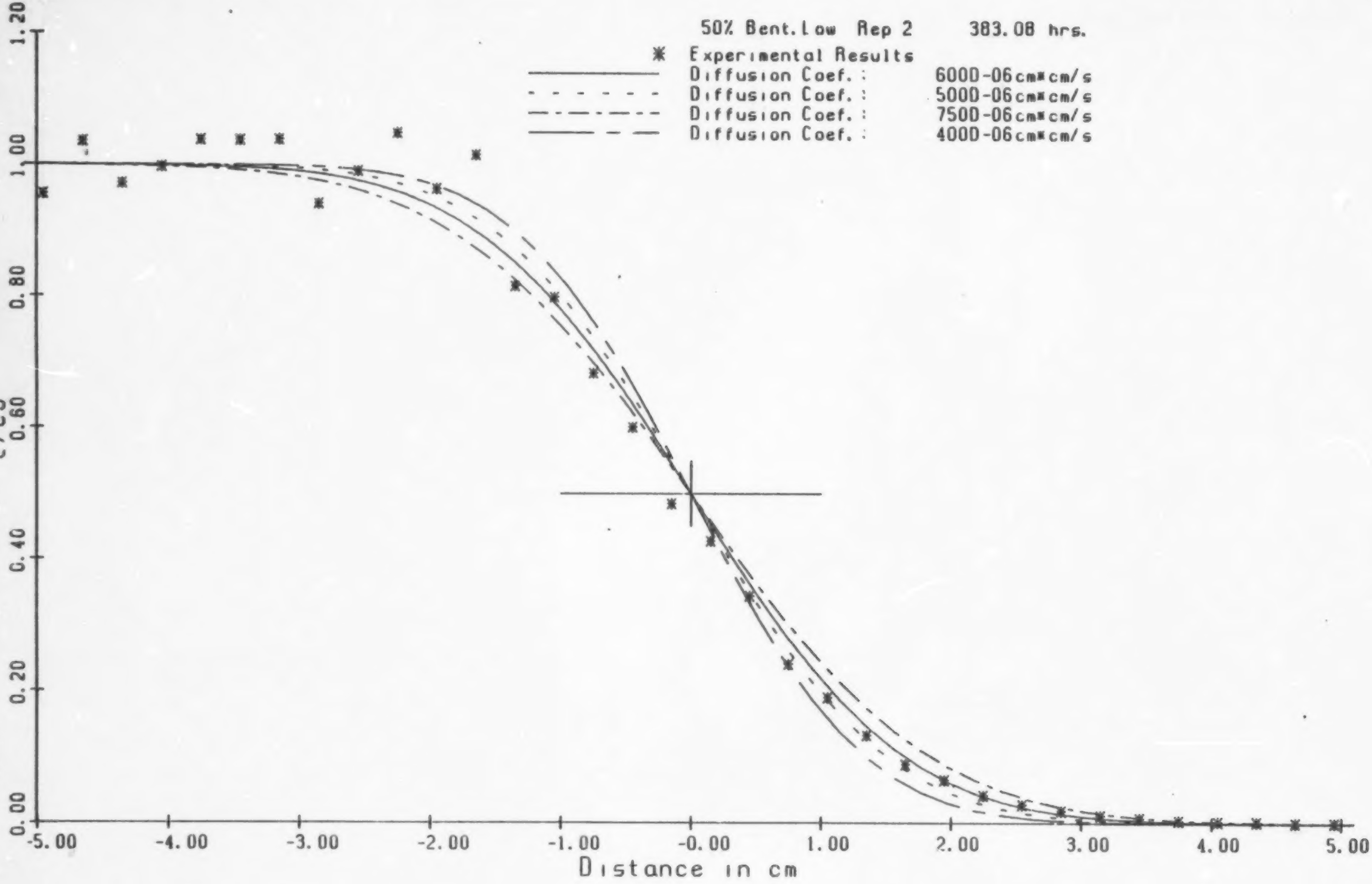

25% Bent.Low Rep 2 212.75 hrs.
✱ Experimental Results
Diffusion Coef. 6000-06cm*cm/s
Diffusion Coef. 8000-06cm*cm/s
Diffusion Coef. 4000-06cm*cm/s
Diffusion Coef. 2000-06cm*cm/s
C/C0
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

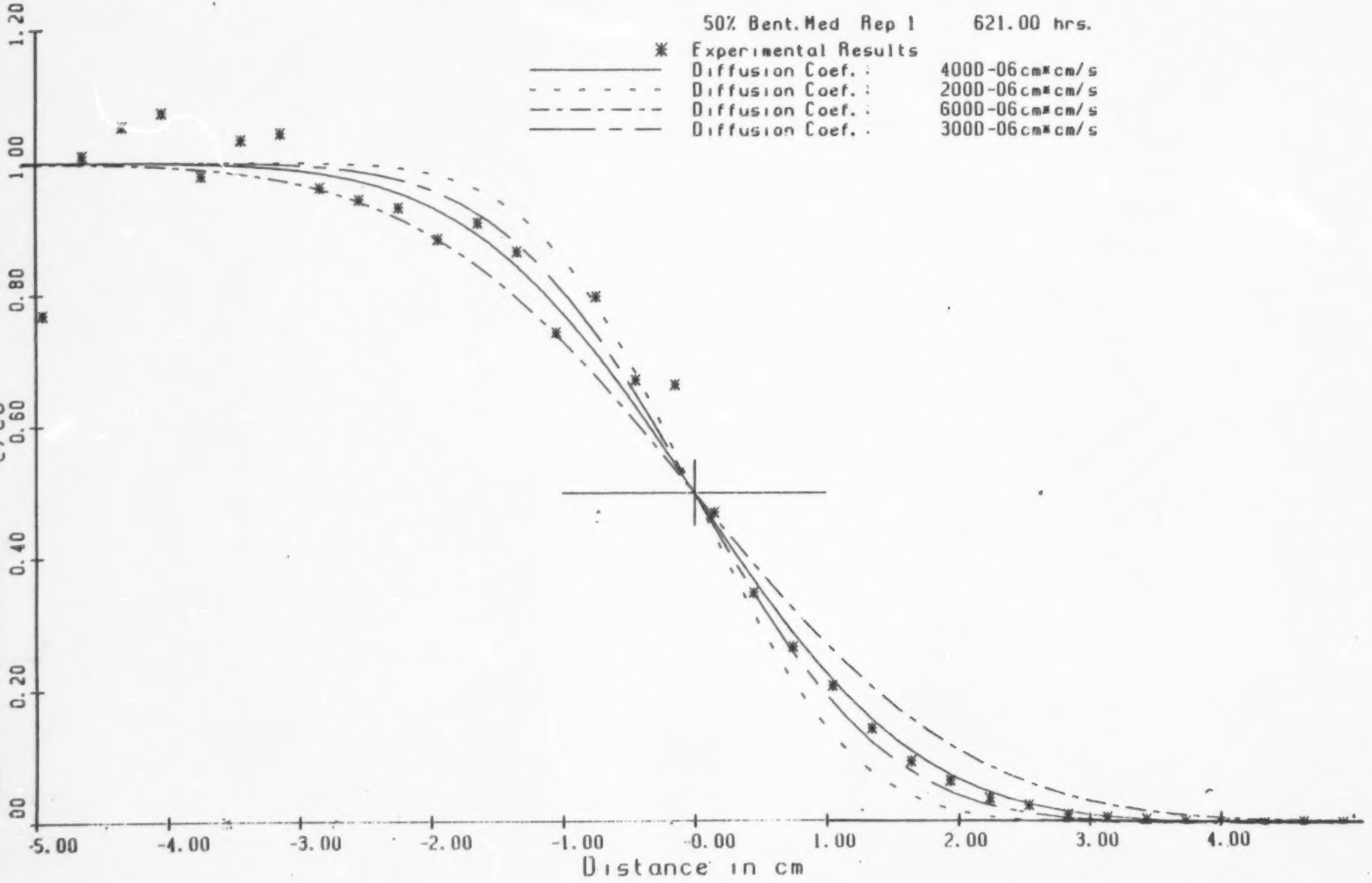

25% Bent. Med Rep 1 258.50 hrs.
* Experimental Results
Diffusion Coef.: 6000-06cm*cm/s
Diffusion Coef.: 4000-06cm*cm/s
Diffusion Coef.: 8000-06cm*cm/s
Diffusion Coef.: 5000-06cm*cm/s
C/CO
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

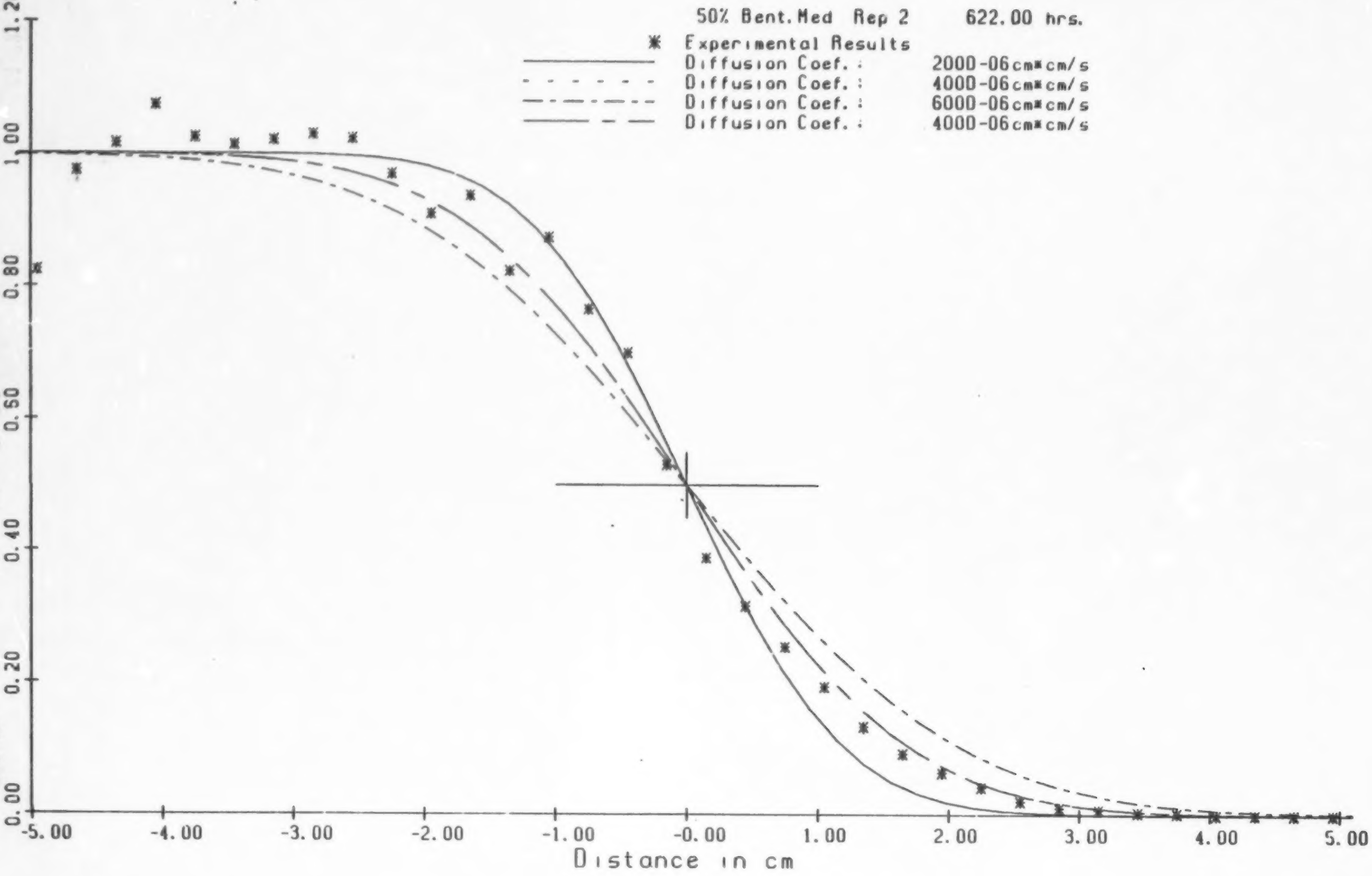

25% Bent. Med Rep 2 259.75 hrs.
Experimental Results
Diffusion Coef. : 6000-06cm*cm/s
Diffusion Coef. : 4000-06cm*cm/s
Diffusion Coef. : 8000-06cm*cm/s
Diffusion Coef. : 2000-06cm*cm/s
C/CO
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

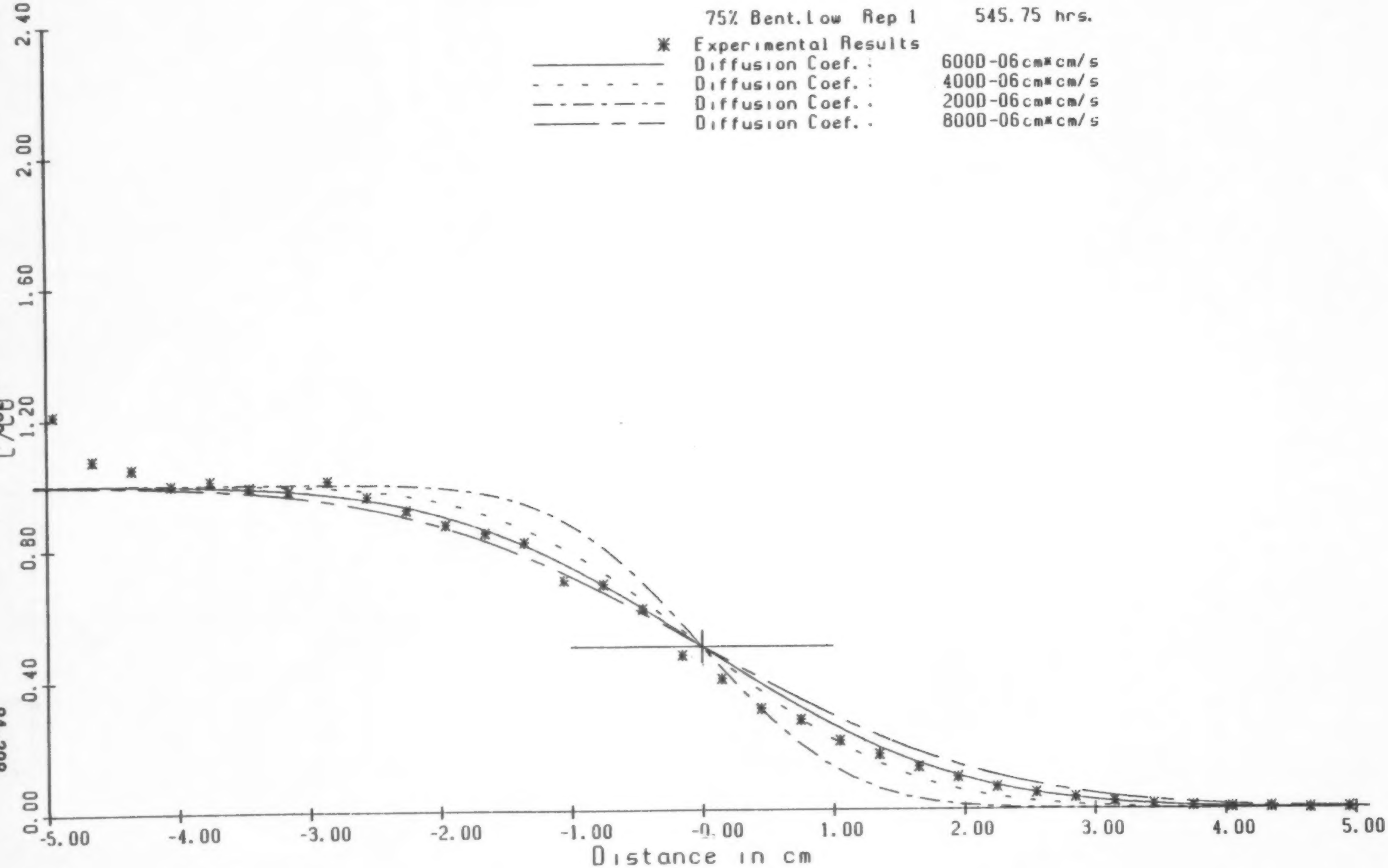

50% Bent.Low Rep 1 381.75 hrs.
Experimental Results
Diffusion Coef. 6000-06cm*cm/s
Diffusion Coef. 8000-06cm*cm/s
Diffusion Coef. 2000-06cm*cm/s
Diffusion Coef. 4000-06cm*cm/s
C/CO
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

84-298

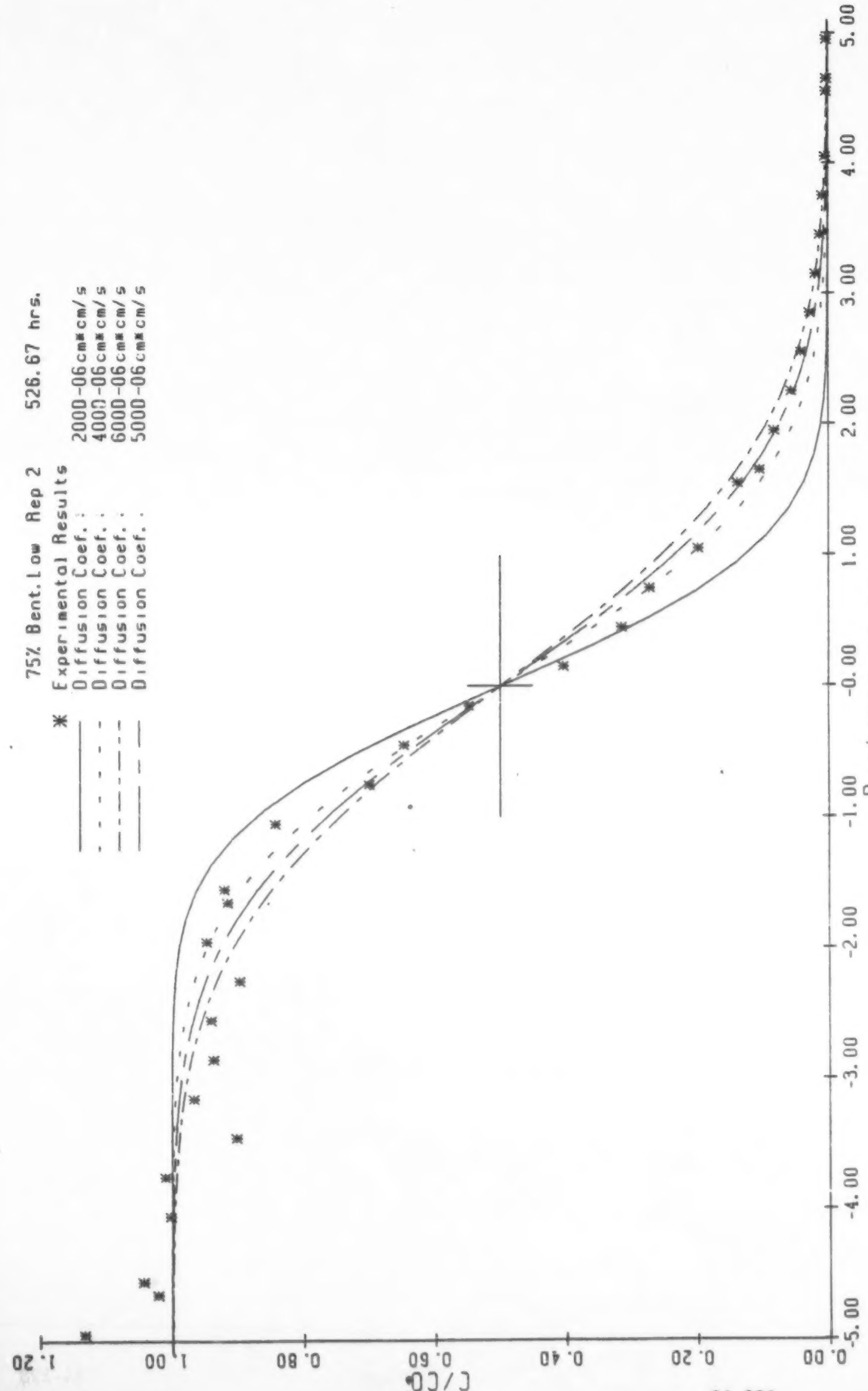

50% Bent.Low Rep 2 383.08 hrs.
* Experimental Results
Diffusion Coef.: 6000-06cm*cm/s
Diffusion Coef.: 5000-06cm*cm/s
Diffusion Coef.: 7500-06cm*cm/s
Diffusion Coef.: 4000-06cm*cm/s
C/CO
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm


50% Bent.Med Rep 1 621.00 hrs.
Experimental Results
Diffusion Coef.: 4000-06cm*cm/s
Diffusion Coef.: 2000-06cm*cm/s
Diffusion Coef.: 6000-06cm*cm/s
Diffusion Coef.: 3000-06cm*cm/s
C/C0
1.20
1.00
0.80
0.60
0.40
0.20
00
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
Distance in cm

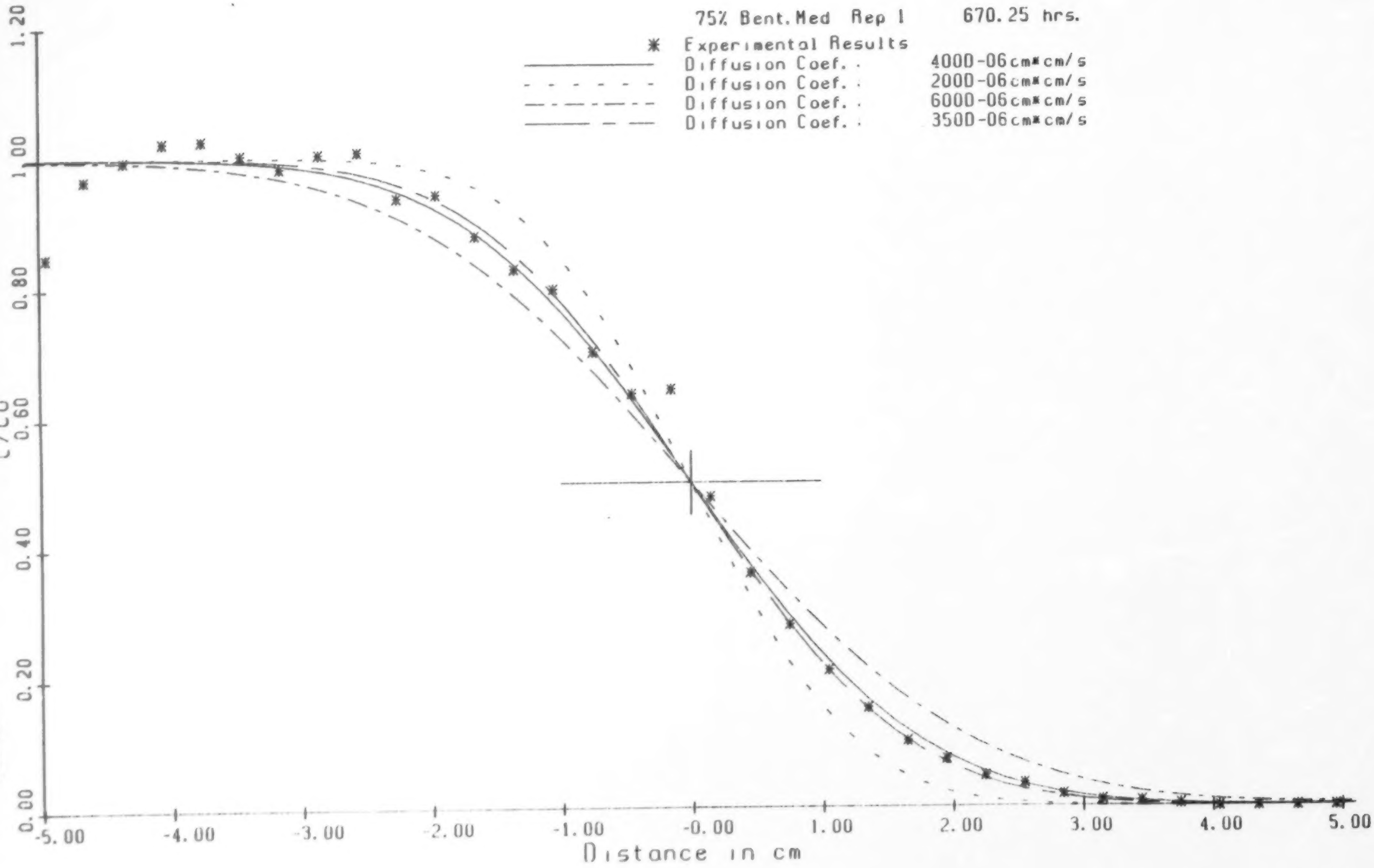
50% Bent.Med Rep 2 622.00 hrs.
✱ Experimental Results
Diffusion Coef.: 2000-06cm*cm/s
Diffusion Coef.: 4000-06cm*cm/s
Diffusion Coef.: 6000-06cm*cm/s
Diffusion Coef.: 4000-06cm*cm/s
C/C0
0.00
0.20
0.40
0.50
0.80
1.00
1.20
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

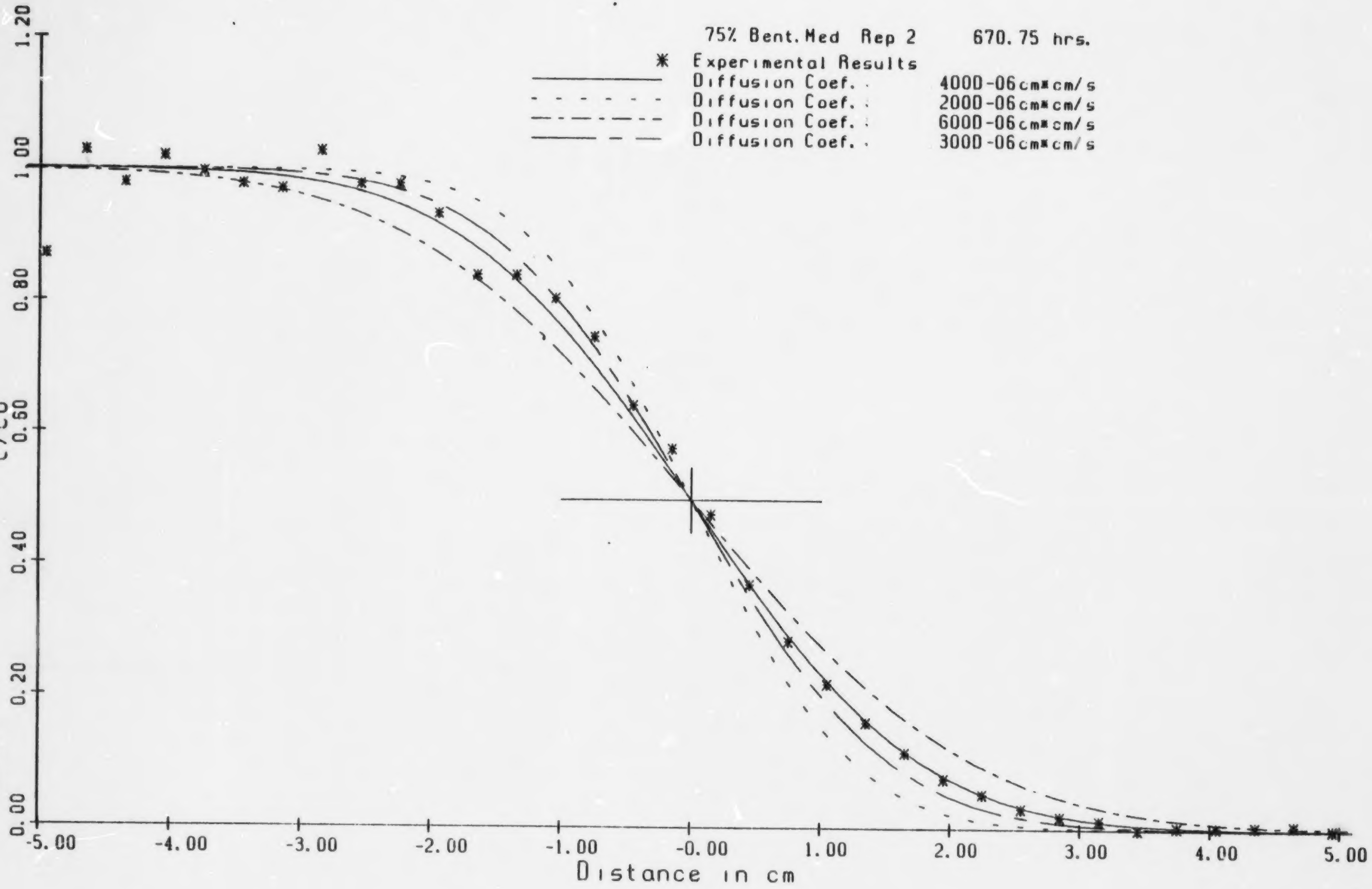

75% Bent.Low Rep 1 545.75 hrs.
Experimental Results
Diffusion Coef.: 6000-06cm*cm/s
Diffusion Coef.: 4000-06cm*cm/s
Diffusion Coef.: 2000-06cm*cm/s
Diffusion Coef.: 8000-06cm*cm/s
C/C0
0.00
0.40
0.80
1.20
1.60
2.00
2.40
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

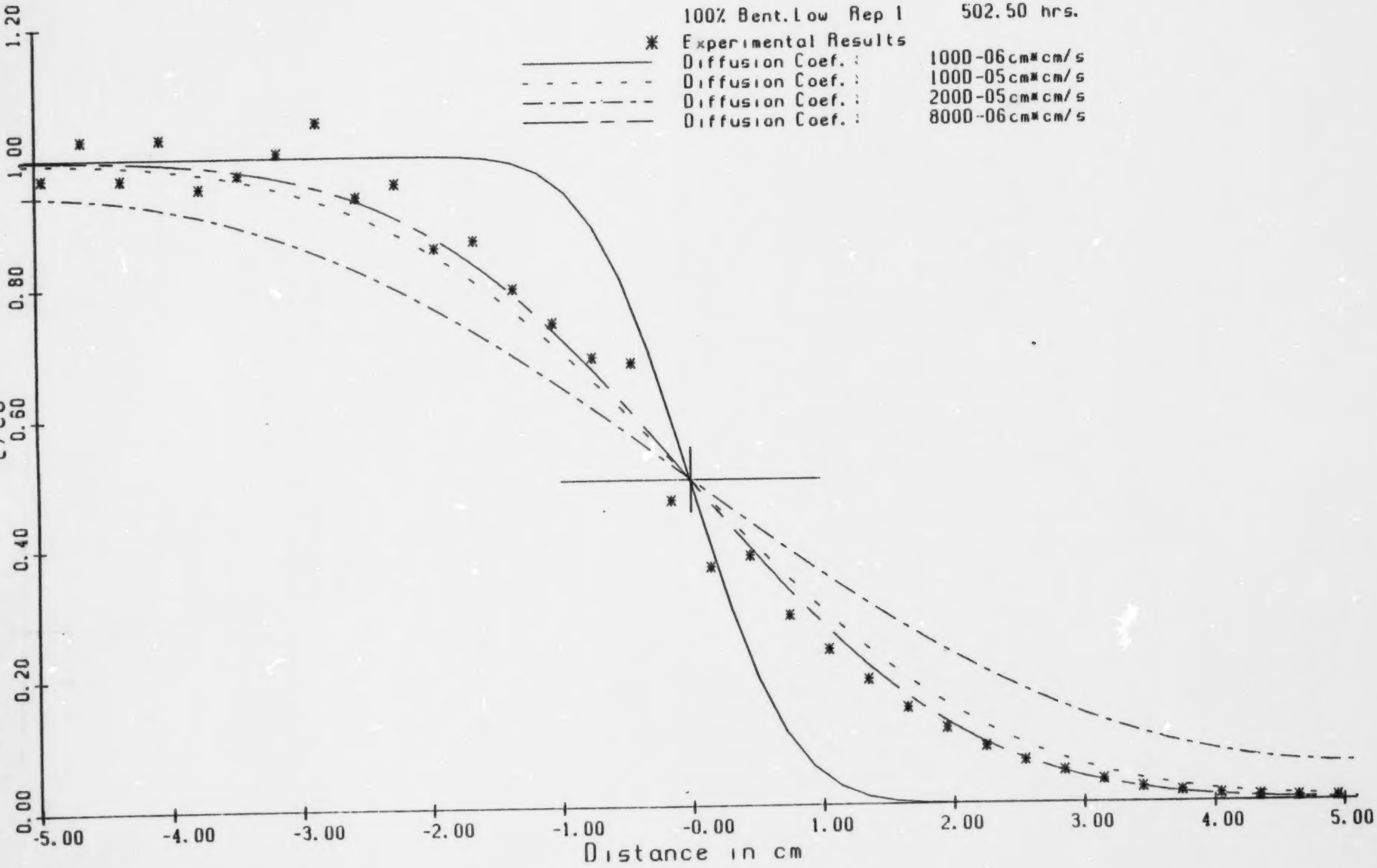
84-298

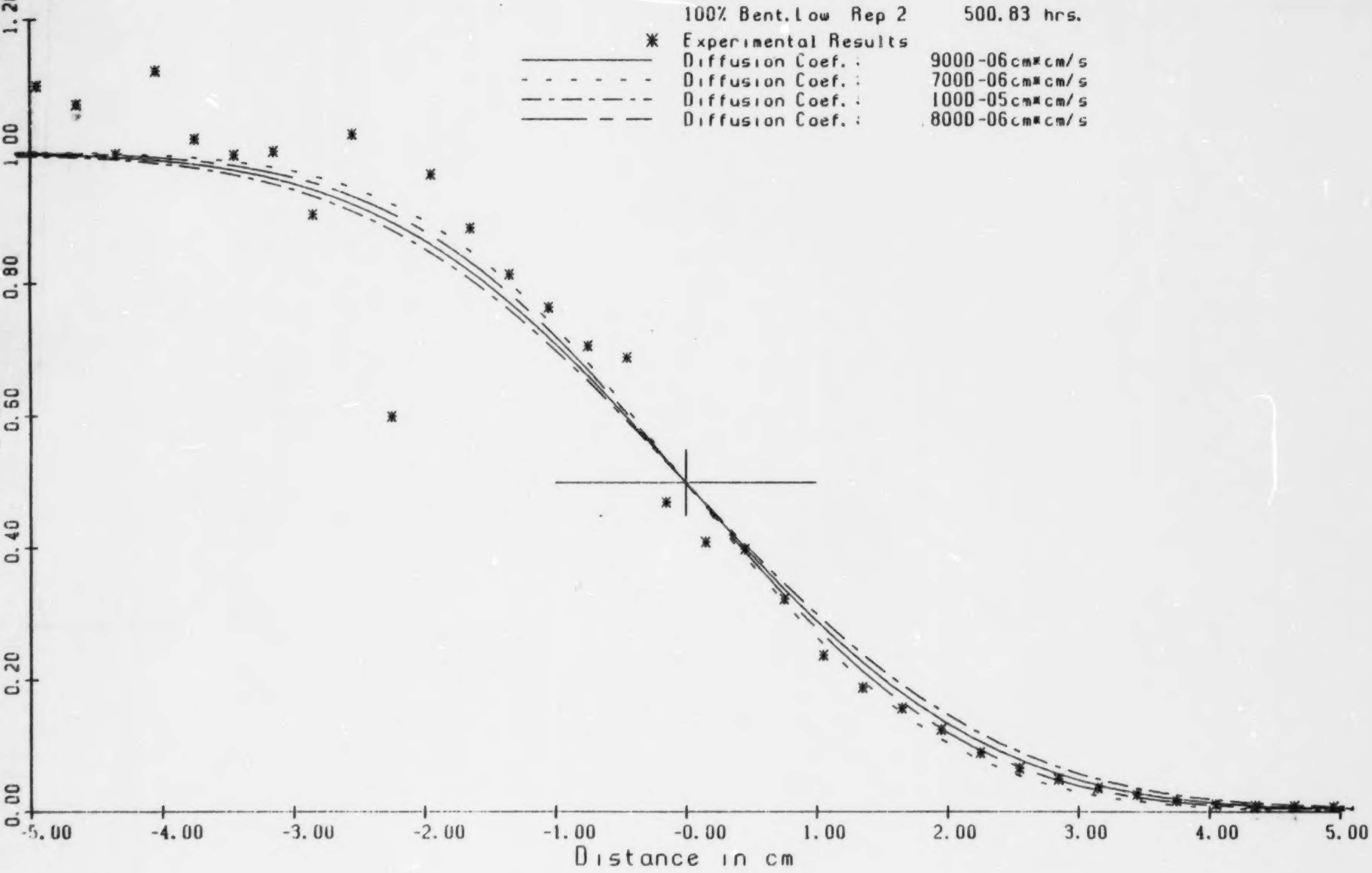


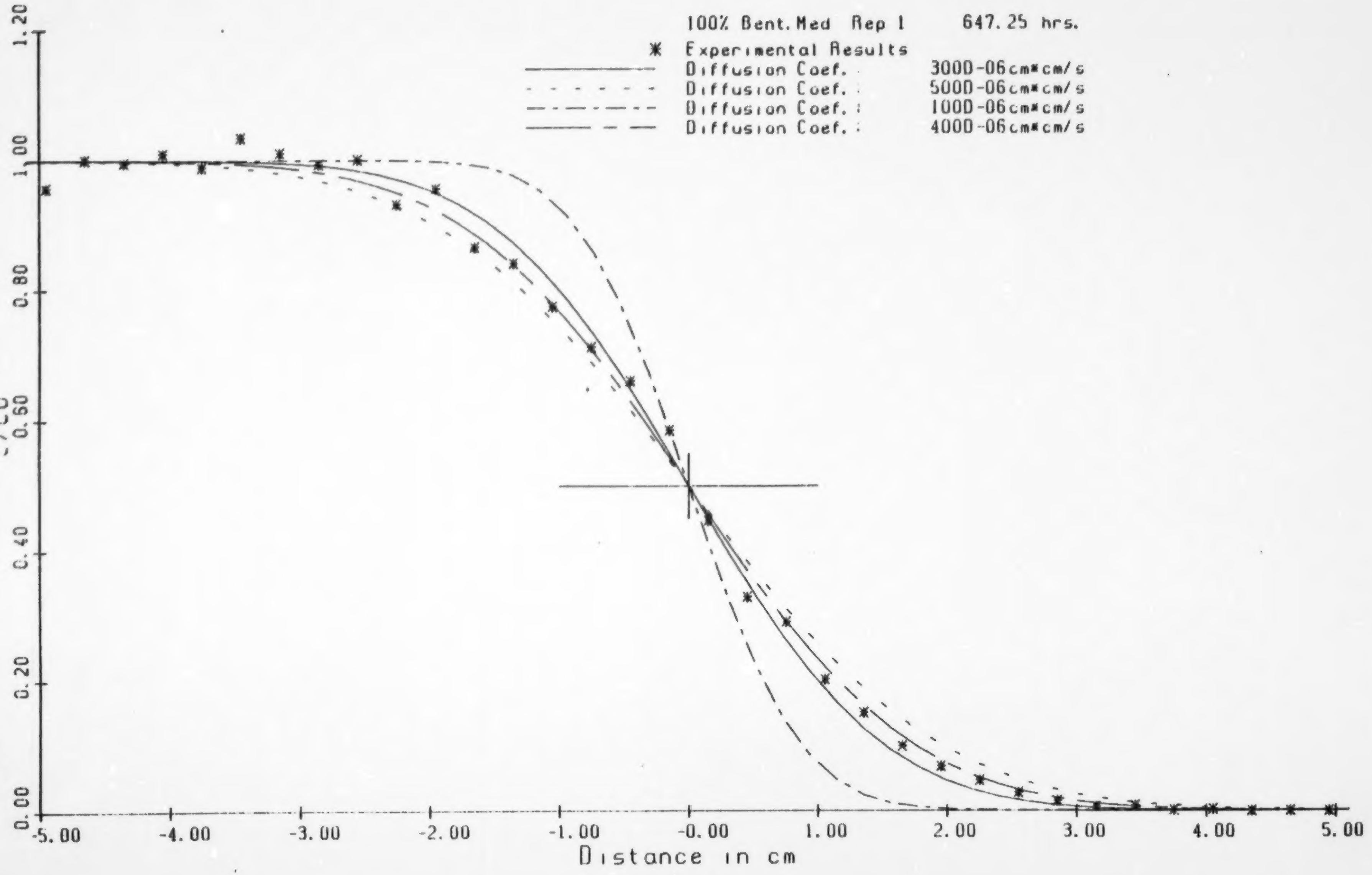
75% Bent.Low Rep 2
526.67 hrs.
Experimental Results
Diffusion Coef. : 2000-06cm*cm/s
Diffusion Coef. : 4000-06cm*cm/s
Diffusion Coef. : 6000-06cm*cm/s
Diffusion Coef. : 5000-06cm*cm/s
Distance in cm
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
C/CO
0.00
0.20
0.40
0.60
0.80
1.00
1.20

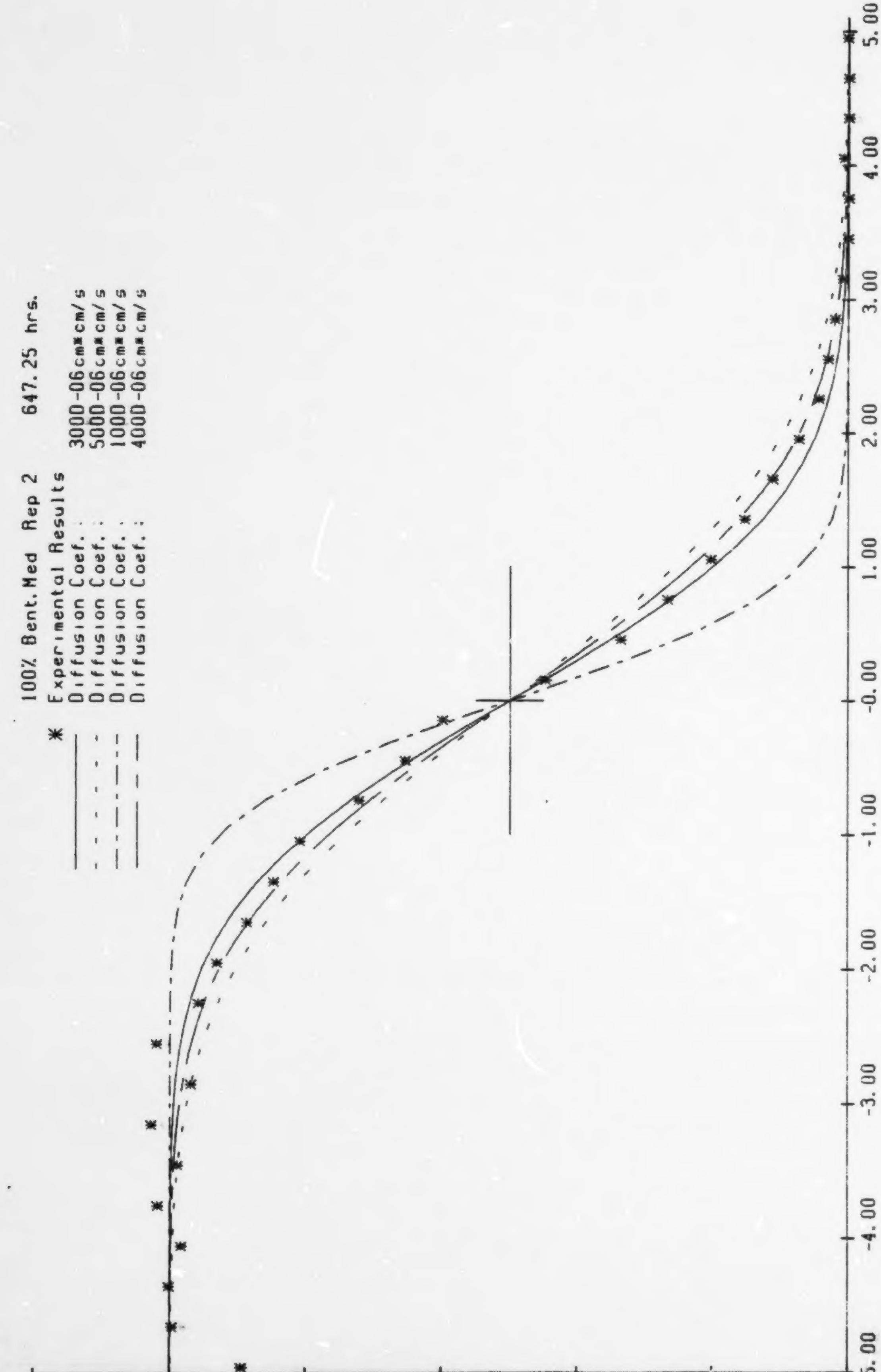

75% Bent.Med Rep I 670.25 hrs.
* Experimental Results
Diffusion Coef. 400D-06cm*cm/s
Diffusion Coef. 200D-06cm*cm/s
Diffusion Coef. 600D-06cm*cm/s
Diffusion Coef. 350D-06cm*cm/s
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm


75% Bent.Med Rep 2 670.75 hrs.
Experimental Results
Diffusion Coef. : 4000-06cm*cm/s
Diffusion Coef. : 2000-06cm*cm/s
Diffusion Coef. : 6000-06cm*cm/s
Diffusion Coef. : 3000-06cm*cm/s
C/C0
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

100% Bent.Low Rep 1 502.50 hrs.
Experimental Results
Diffusion Coef.: 1000-06cm*cm/s
Diffusion Coef.: 1000-05cm*cm/s
Diffusion Coef.: 2000-05cm*cm/s
Diffusion Coef.: 8000-06cm*cm/s
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm


100% Bent.Low Rep 2 500.83 hrs.
Experimental Results
Diffusion Coef.: 9000-06cm*cm/s
Diffusion Coef.: 7000-06cm*cm/s
Diffusion Coef.: 1000-05cm*cm/s
Diffusion Coef.: 8000-06cm*cm/s
1.20
1.00
0.80
0.60
0.40
0.20
0.00
C/C0
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm


100% Bent. Med Rep 1 647.25 hrs.
* Experimental Results
Diffusion Coef. 300D-06cm*cm/s
Diffusion Coef. : 500D-06cm*cm/s
Diffusion Coef. : 100D-06cm*cm/s
Diffusion Coef. : 400D-06cm*cm/s
1.20
1.00
0.80
0.60
0.40
0.20
0.00
C/C0
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm


100% Bent.Med Rep 2
647.25 hrs.
Experimental Results
Diffusion Coef. : 3000-06cm*cm/s
Diffusion Coef. : 5000-06cm*cm/s
Diffusion Coef. : 1000-06cm*cm/s
Diffusion Coef. : 4000-06cm*cm/s
Distance in cm
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20

Appendix C2

UNIVERSITY OF WATERLOO RESULTS

0% BENTONITE

Low Bulk Density

			Water Content			
X (cm)	C / C0	Bulk Density (g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.85	1.007864	1.8397	0.0971	0.1787	0.3058	0.5844
-4.35	1.023021	1.7877	0.0973	0.1739	0.3254	0.5343
-3.85	0.979241	1.9062	0.0998	0.1902	0.2807	0.6778
-3.35	1.086900	1.8036	0.0996	0.1796	0.3194	0.5623
-2.85	1.020384	1.7662	0.0997	0.1761	0.3335	0.5281
-2.35	1.093393	1.2147*	0.1009	0.1226*	0.5416*	0.2263*
-1.85	0.918681	1.6807	0.0978	0.1643	0.3658	0.4491
-1.35	0.726639	2.0225	0.0925	0.1870	0.2368	0.7897
-0.85	0.715753	1.0362	0.0847	0.0878	0.6090	0.1442
-0.30	0.513073	1.6957	0.0897	0.1520	0.3601	0.4222
0.25	0.416150	1.9326	0.0867	0.1676	0.2707	0.6192
0.75	0.248658	1.9364*	0.0854	0.1654*	0.2693*	0.6144*
1.25	0.112793	1.9921	0.0829	0.1652	0.2483	0.6652
1.75	0.055438	1.3481	0.0838	0.1129	0.4913	0.2299
2.25	0.023762	1.8292	0.0883	0.1616	0.3097	0.5216
2.75	0.008247	1.9765	0.0869	0.1717	0.2542	0.6754
3.25	0.002841	1.9972	0.0867	0.1733	0.2464	0.7033
3.75	0.001258	1.9194	0.0908	0.1742	0.2757	0.6318
4.25	0.0	1.9065	0.0865	0.1649	0.2806	0.5876
4.75	0.000879	1.9226	0.0896	0.1723	0.2745	0.6277

Rep. 1, Time: 495000 s, C0: 298 cpm/g
Average Bulk Density................1.8306 g/cc
Average Gravimetric Water Content...0.0913 g/g
Average Volumetric Water Content....0.1670 cc/cc
Average Porosity....................0.3092 cc/cc
Average Saturation..................0.5743 cc/cc

* Values omitted in calculation of averages because of spilled soil.

0% BENTONITE

Low Bulk Density

			Water Content			
X (cm)	C / C0	Bulk Density (g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.75	0.993345	1.7893	0.0945	0.1690	0.3248	0.5204
-4.25	1.009450	1.8529	0.0967	0.1792	0.3008	0.5958
-3.75	1.112557	2.1212	0.1002	0.2126	0.1995	1.0652
-3.25	1.016439	1.8214	0.0990	0.1803	0.3127	0.5768
-2.75	1.017541	1.7953	0.0978	0.1756	0.3225	0.5443
-2.25	0.948423	1.9427	0.0831	0.1614	0.2669	0.6047
-1.75	0.978560	1.8071	0.0960	0.1734	0.3181	0.5452
-1.25	0.881157	1.9732	0.1005	0.1982	0.2554	0.7761
-0.75	0.738009	1.8810	0.0939	0.1766	0.2902	0.6086
-0.25	0.539230	2.1745	0.0938	0.2040	0.1794	1.1371
0.25	0.369471	1.9389	0.0926	0.1796	0.2683	0.6691
0.75	0.226514	1.9011	0.0894	0.1699	0.2826	0.6011
1.25	0.118949	1.9827	0.0910	0.1803	0.2518	0.7161
1.75	0.056334	1.9049	0.0950	0.1811	0.2812	0.6440
2.25	0.022814	1.9307	0.0944	0.1822	0.2714	0.6713
2.75	0.009221	1.9621	0.0977	0.1918	0.2596	0.7389
3.25	0.002973	1.8468	0.0952	0.1758	0.3031	0.5801
3.75	0.001616	1.8530*	0.0932	0.1727*	0.3008*	0.5741*
4.25	0.0	2.0070	0.0952	0.1911	0.2426	0.7876
4.75	0.001197	2.0842	0.0965	0.2012	0.2135	0.9424

Rep. 2, Time: 499500 s, C0: 288 cpm/g
Average Bulk Density................1.9325 g/cc
Average Gravimetric Water Content...0.0948 g/g
Average Volumetric Water Content....0.1833 cc/cc
Average Porosity....................0.2708 cc/cc
Average Saturation..................0.7013 cc/cc

* Values omitted in calculation of averages because of spilled soil.

10% BENTONITE

Low Bulk Density

X (cm)	C / CO	Bulk Density (g/cc)	Water Content Gravimetric (g/g)	Water Content Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.80	0.927058	1.7118	0.1834	0.3140	0.3683	0.8524
-4.25	0.975209	1.6962	0.1869	0.3171	0.3741	0.8476
-3.75	0.996461	1.6827	0.1874	0.3153	0.3791	0.8317
-3.25	0.988547	1.7015	0.1880	0.3199	0.3722	0.8595
-2.75	0.957866	1.6948	0.1881	0.3188	0.3746	0.8509
-2.25	0.902170	1.7539	0.1862	0.3265	0.3528	0.9255
-1.75	0.863943	1.6484	0.1877	0.3094	0.3917	0.7899
-1.25	0.752008	1.7344	0.1841	0.3192	0.3600	0.8867
-0.75	0.688094	1.7148	0.1804	0.3094	0.3672	0.8424
-0.25	0.562332	1.6694	0.1700	0.2838	0.3840	0.7390
0.25	0.409849	1.8524	0.1673	0.3099	0.3165	0.9792
0.75	0.312247	1.7453	0.1782	0.3110	0.3560	0.8736
1.25	0.228367	1.6885	0.1824	0.3080	0.3769	0.8171
1.75	0.154051	1.7191	0.1850	0.3180	0.3657	0.8696
2.25	0.109078	1.7259	0.1864	0.3217	0.3631	0.8858
2.75	0.064087	1.6520	0.1869	0.3087	0.3904	0.7908
3.25	0.036354	1.7275	0.1849	0.3193	0.3626	0.8808
3.75	0.022613	1.7039	0.1854	0.3159	0.3712	0.8510
4.25	0.010976	1.7650	0.1839	0.3246	0.3487	0.9309
4.80	0.005343	1.6713	0.1769	0.2956	0.3833	0.7713

Rep. 1, Time: 2604600 s, C0: 507 cpm/g
Average Bulk Density................1.7129 g/cc
Average Gravimetric Water Content...0.1830 g/g
Average Volumetric Water Content....0.3133 cc/cc
Average Porosity....................0.3585 cc/cc
Average Saturation..................0.8765 cc/cc

10% BENTONITE

Low Bulk Density

			Water Content			
X (cm)	C / C0	Bulk Density (g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.80	0.934523	1.6222	0.1859	0.3016	0.3924	0.7685
-4.25	1.008567	1.6334	0.1909	0.3118	0.3882	0.8032
-3.75	0.986494	1.7325	0.1892	0.3279	0.3511	0.9338
-3.25	0.996532	1.6635	0.1907	0.3172	0.3770	0.8415
-2.75	0.954820	1.6931	0.1905	0.3225	0.3659	0.8814
-2.25	0.887503	1.6956	0.1885	0.3197	0.3649	0.8760
-1.75	0.875979	1.7060	0.1872	0.3194	0.3610	0.8847
-1.25	0.777513	1.7049	0.1859	0.3169	0.3615	0.8766
-0.75	0.692091	1.6852	0.1855	0.3126	0.3688	0.8475
-0.25	0.537650	1.8425	0.1711	0.3152	0.3099	1.0172
0.25	0.410334	1.7542	0.1698	0.2978	0.3430	0.8684
0.75	0.324289	1.7431	0.1837	0.3202	0.3472	0.9222
1.25	0.232354	1.6895	0.1863	0.3147	0.3672	0.8569
1.75	0.157815	1.7431	0.1873	0.3264	0.3472	0.9402
2.25	0.105363	1.6721	0.1880	0.3144	0.3737	0.8411
2.75	0.067184	1.7165	0.1888	0.3242	0.3571	0.9077
3.25	0.038633	1.6815	0.1881	0.3162	0.3702	0.8542
3.75	0.021130	1.7380	0.1869	0.3248	0.3491	0.9305
4.25	0.009001	1.7541	0.1872	0.3283	0.3430	0.9571
4.80	0.004749	1.7330	0.1812	0.3141	0.3509	0.8949

Rep. 2, Time: 2605500 s, C0: 517 cpm/g
Average Bulk Density................1.7102 g/cc
Average Gravimetric Water Content...0.1856 g/g
Average Volumetric Water Content....0.3173 cc/cc
Average Porosity....................0.3595 cc/cc
Average Saturation..................0.8852 cc/cc

10% BENTONITE

High Bulk Density

X (cm)	C / C0	Bulk Density (g/cc)	Water Content Gravimetric (g/g)	Water Content Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-3.35	********	1.7221	0.0499	0.0860	0.3550	0.2421
-3.05	1.030392	2.0829	0.0539	0.1123	0.2199	0.5107
-2.75	********	2.4509	0.0545	0.1335	0.0821	1.6262
-2.45	1.056864	1.9713	0.0542	0.1068	0.2617	0.4080
-2.15	********	2.1878	0.0545	0.1191	0.1806	0.6597
-1.90	1.040197	2.1692	0.0524	0.1137	0.1876	0.6063
-1.70	********	2.0492	0.0544	0.1115	0.2325	0.4795
-1.50	0.895458	2.1775	0.0528	0.1150	0.1844	0.6234
-1.30	********	2.2286	0.0535	0.1191	0.1653	0.7207
-1.10	0.894920	2.0642	0.0540	0.1115	0.2269	0.4913
-0.90	********	2.2082	0.0534	0.1180	0.1730	0.6820
-0.70	0.724746	2.1434	0.0540	0.1157	0.1972	0.5867
-0.50	0.697977	2.3787	0.0546	0.1298	0.1091	1.1901
-0.30	0.571622	2.1397	0.0564	0.1207	0.1986	0.6079
-0.10	0.721175	2.0137	0.0773	0.1557	0.2458	0.6332
0.10	0.547283	2.1012	0.0788	0.1656	0.2130	0.7772
0.30	0.332811	2.1374	0.0554	0.1183	0.1995	0.5931
0.50	0.311137	2.0830	0.0551	0.1148	0.2199	0.5222
0.70	0.312808	2.2831	0.0522	0.1191	0.1449	0.8220
0.90	********	2.3398	0.0519	0.1216	0.1237	0.9830
1.10	0.147706	1.9416	0.0500	0.0971	0.2728	0.3559
1.30	********	2.2633	0.0505	0.1143	0.1523	0.7501
1.50	0.134589	2.0995	0.0511	0.1073	0.2137	0.5024
1.70	********	2.2794	0.0513	0.1169	0.1463	0.7989
1.90	0.033643	2.1311	0.0513	0.1092	0.2018	0.5412
2.15	********	2.1658	0.0513	0.1111	0.1888	0.5886
2.45	0.0	2.0380	0.0502	0.1023	0.2367	0.4320
2.75	********	2.0343	0.0505	0.1027	0.2381	0.4315
3.05	0.0	2.0651	0.0499	0.1030	0.2266	0.4548
3.35	********	2.0479	0.0477	0.0977	0.2330	0.4194

Rep. 1, Time: 2323500 s, C0: 640 cpm/100g
Average Bulk Density................2.1333 g/cc
Average Gravimetric Water Content...0.0542 g/g
Average Volumetric Water Content....0.1156 cc/cc
Average Porosity....................0.2010 cc/cc
Average Saturation..................0.6347 cc/cc

10% BENTONITE

High Bulk Density

			Water Content			
X (cm)	C / C0	Bulk Density (g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-3.35	********	1.9976	0.0455	0.0909	0.2518	0.3611
-3.05	0.970937	1.8939	0.0459	0.0870	0.2907	0.2992
-2.75	********	2.2162	0.0487	0.1079	0.1700	0.6349
-2.45	0.898265	2.1389	0.0491	0.1051	0.1989	0.5283
-2.15	********	2.1609	0.0489	0.1056	0.1907	0.5536
-1.90	1.026371	2.0833	0.0511	0.1065	0.2197	0.4848
-1.70	********	2.0578	0.0506	0.1042	0.2293	0.4544
-1.50	1.068692	2.1258	0.0506	0.1075	0.2038	0.5275
-1.30	********	2.1862	0.0501	0.1095	0.1812	0.6043
-1.10	0.919802	2.1734	0.0514	0.1117	0.1860	0.6003
-0.90	********	2.2664	0.0499	0.1130	0.1511	0.7476
-0.70	0.837630	2.0459	0.0492	0.1006	0.2337	0.4303
-0.50	0.720498	2.2770	0.0497	0.1132	0.1472	0.7691
-0.30	0.681462	2.0527	0.0508	0.1043	0.2312	0.4510
-0.10	0.724088	2.1299	0.0691	0.1472	0.2023	0.7276
0.10	0.476907	2.1784	0.0649	0.1413	0.1841	0.7678
0.30	0.405007	2.0723	0.0500	0.1036	0.2239	0.4626
0.50	0.271240	2.1302	0.0497	0.1059	0.2022	0.5238
0.70	0.169971	2.3903	0.0484	0.1156	0.1047	1.1038
0.90	********	2.0571	0.0480	0.0988	0.2296	0.4303
1.10	0.091370	2.1541	0.0476	0.1025	0.1932	0.5303
1.30	********	2.1341	0.0469	0.1001	0.2007	0.4989
1.50	0.104279	2.1705	0.0470	0.1021	0.1871	0.5459
1.70	********	2.1323	0.0495	0.1055	0.2014	0.5240
1.90	0.0	2.0166	0.0487	0.0983	0.2447	0.4015
2.15	********	2.1298	0.0489	0.1042	0.2023	0.5150
2.45	0.0	2.1905	0.0489	0.1071	0.1796	0.5965
2.75	********	2.1545	0.0506	0.1090	0.1931	0.5645
3.05	0.0	2.0294	0.0500	0.1015	0.2399	0.4230
3.35	********	1.8072	0.0471	0.0851	0.3231	0.2632

Rep. 2, Time: 2329800 s, C0: 640 cpm/100g
Average Bulk Density................2.1184 g/cc
Average Gravimetric Water Content...0.0502 g/g
Average Volumetric Water Content....0.1065 cc/cc
Average Porosity....................0.2066 cc/cc
Average Saturation..................0.5442 cc/cc

25% BENTONITE

Low Bulk Density

X (cm)	C / C0	Bulk Density (g/cc)	Water Content Gravimetric (g/g)	Water Content Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.80	0.868284	1.2306	0.3171	0.3902	0.5425	0.7192
-4.25	1.043530	1.1486	0.5049	0.5799	0.5730	1.0120
-3.75	1.069221	1.1138	0.5886	0.6555	0.5860	1.1188
-3.25	0.795922	1.5156	0.4091	0.6201	0.4366	1.4202
-2.75	0.911813	1.2228	0.3844	0.4701	0.5454	0.8619
-2.25	0.835434	1.3150	0.3224	0.4239	0.5111	0.8294
-1.75	0.911600	1.1274	0.5213	0.5877	0.5809	1.0118
-1.25	1.069386	0.8466	1.0096	0.8547	0.6853	1.2473
-0.75	0.618364	1.3588	0.2869	0.3898	0.4949	0.7877
-0.25	0.628298	1.1997	0.5244	0.6291	0.5540	1.1355
0.25	0.359100	1.3580	0.1444	0.1961	0.4952	0.3960
0.75	0.415075	1.0256	0.7968	0.8172	0.6187	1.3208
1.25	0.217229	1.3046	0.3214	0.4192	0.5150	0.8140
1.75	0.169577	1.1666	0.4442	0.5182	0.5663	0.9151
2.25	0.105198	1.2986	0.1475	0.1915	0.5172	0.3703
2.75	0.062457	1.2277	0.3211	0.3942	0.5436	0.7251
3.25	0.036532	1.3362	0.2630	0.3514	0.5033	0.6982
3.75	0.020130	1.2515	0.4325	0.5412	0.5348	1.0121
4.25	0.012189	1.2525	0.3924	0.4915	0.5344	0.9197
4.80	0.006355	1.2110	0.3818	0.4624	0.5498	0.8410

Rep. 1, Time: 2426400 s, C0: 1145 cpm/g
Average Bulk Density................1.2255 g/cc
Average Gravimetric Water Content...0.4257 g/g
Average Volumetric Water Content....0.4992 cc/cc
Average Porosity....................0.5444 cc/cc
Average Saturation..................0.9078 cc/cc

25% BENTONITE

Low Bulk Density

			Water Content			
X (cm)	C / C0	Bulk Density (g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.75	0.943620	1.3234	0.3968	0.5250	0.5080	1.0335
-4.25	0.976999	1.2802	0.4032	0.5162	0.5241	0.9849
-3.75	0.959141	1.2284	0.3638	0.4469	0.5433	0.8225
-3.25	1.040475	1.1862	0.5507	0.6532	0.5590	1.1685
-2.75	1.004086	1.1105	0.4858	0.5395	0.5872	0.9188
-2.25	0.882318	1.2811	0.3776	0.4838	0.5238	0.9237
-1.75	0.804371	1.2639	0.3647	0.4609	0.5301	0.8695
-1.25	0.820095	1.1458	0.4921	0.5638	0.5741	0.9821
-0.75	0.551148	1.4786	0.1210	0.1789	0.4503	0.3973
-0.25	0.718639	1.0896	0.6776	0.7384	0.5949	1.2411
0.25	0.379298	1.2296	0.2493	0.3065	0.5429	0.5645
0.75	0.355217	1.1451	0.5300	0.6069	0.5743	1.0566
1.25	0.185296	1.3406	0.0120	0.0161	0.5016	0.0321
1.75	0.163277	1.3315	0.2962	0.3944	0.5050	0.7809
2.25	0.120560	1.1770	0.4910	0.5779	0.5625	1.0274
2.75	0.069740	1.2652	0.4118	0.5210	0.5297	0.9836
3.25	0.035406	1.3402	0.2726	0.3654	0.5018	0.7281
3.75	0.020083	1.4134	0.2402	0.3395	0.4746	0.7154
4.25	0.012610	1.3670	0.2919	0.3990	0.4918	0.8114
4.80	0.005651	1.2688	0.4402	0.5585	0.5283	1.0572

Rep. 2, Time: 2428200 s, C0: 1146 cpm/g
Average Bulk Density................1.2633 g/cc
Average Gravimetric Water Content...0.3734 g/g
Average Volumetric Water Content....0.4596 cc/cc
Average Porosity....................0.5304 cc/cc
Average Saturation..................0.8550 cc/cc

25% BENTONITE

High Bulk Density

X (cm)	C / CO	Bulk Density (g/cc)	Water Content Gravimetric (g/g)	Water Content Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-3.35	********	2.1609	0.0769	0.1662	0.1967	0.8451
-3.05	0.943774	2.2361	0.0789	0.1764	0.1687	1.0452
-2.75	********	1.9054	0.0777	0.1480	0.2917	0.5073
-2.45	0.981919	2.1684	0.0778	0.1686	0.1939	0.8695
-2.15	********	2.0945	0.0831	0.1740	0.2214	0.7860
-1.90	1.082947	2.0862	0.0826	0.1724	0.2245	0.7680
-1.70	********	2.0841	0.0816	0.1700	0.2253	0.7549
-1.50	1.080643	2.0279	0.0806	0.1635	0.2461	0.6642
-1.30	********	2.1302	0.0850	0.1810	0.2081	0.8699
-1.10	1.169807	2.0515	0.0835	0.1712	0.2374	0.7213
-0.90	********	2.0524	0.0784	0.1610	0.2370	0.6791
-0.70	0.904112	2.1989	0.0804	0.1768	0.1826	0.9683
-0.50	0.933529	2.0428	0.0824	0.1682	0.2406	0.6993
-0.30	0.807330	1.9626	0.0840	0.1649	0.2704	0.6099
-0.10	0.585959	2.0294	0.0852	0.1729	0.2456	0.7042
0.10	0.549902	2.2467	0.0857	0.1926	0.1648	1.1690
0.30	0.421308	1.9393	0.0750	0.1455	0.2791	0.5213
0.50	0.317038	2.2537	0.0762	0.1717	0.1622	1.0583
0.70	0.062835	2.0531	0.0755	0.1549	0.2368	0.6544
0.90	********	2.0302	0.0761	0.1544	0.2453	0.6294
1.10	0.067566	2.2276	0.0745	0.1659	0.1719	0.9651
1.30	********	1.8823	0.0728	0.1370	0.3002	0.4564
1.50	0.117890	2.3289	0.0716	0.1668	0.1342	1.2426
1.70	********	1.9224	0.0745	0.1432	0.2854	0.5019
1.90	0.010190	2.1101	0.0738	0.1557	0.2156	0.7224
2.15	********	2.0483	0.0735	0.1506	0.2386	0.6311
2.45	0.012631	2.1824	0.0721	0.1574	0.1887	0.8341
2.75	********	1.9813	0.0743	0.1471	0.2635	0.5585
3.05	0.003792	1.7446	0.0715	0.1248	0.3514	0.3552
3.35	********	2.2859	0.0759	0.1735	0.1502	1.1546

Rep. 1, Time: 2332500 s, CO: 544 cpm/100g
Average Bulk Density................2.0823 g/cc
Average Gravimetric Water Content...0.0780 g/g
Average Volumetric Water Content....0.1625 cc/cc
Average Porosity....................0.2259 cc/cc
Average Saturation..................0.7649 cc/cc

25% BENTONITE

High Bulk Density

X (cm)	C / C0	Bulk Density (g/cc)	Water Content Gravimetric (g/g)	Water Content Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-3.35	********	1.7473	0.0724	0.1265	0.3505	0.3610
-3.05	0.923655	2.1022	0.0735	0.1545	0.2185	0.7071
-2.75	********	2.0572	0.0717	0.1475	0.2352	0.6270
-2.45	0.781647	2.1780	0.0717	0.1563	0.1903	0.8210
-2.15	********	2.0605	0.0697	0.1435	0.2340	0.6134
-1.90	0.770257	2.0549	0.0711	0.1462	0.2361	0.6193
-1.70	********	2.1155	0.0689	0.1458	0.2136	0.6830
-1.50	0.784148	2.2358	0.0693	0.1550	0.1689	0.9180
-1.30	********	1.9436	0.0664	0.1291	0.2775	0.4653
-1.10	0.726007	2.2439	0.0672	0.1509	0.1658	0.9099
-0.90	********	2.1963	0.0687	0.1510	0.1835	0.8227
-0.70	0.696529	2.2510	0.0723	0.1627	0.1632	0.9969
-0.50	0.576770	1.9815	0.0728	0.1443	0.2634	0.5479
-0.30	0.609797	1.9827	0.0694	0.1376	0.2630	0.5232
-0.10	0.532675	2.1331	0.0734	0.1566	0.2070	0.7566
0.10	0.404278	2.1519	0.0813	0.1749	0.2000	0.8744
0.30	0.263257	2.0670	0.0742	0.1533	0.2316	0.6619
0.50	0.211440	2.1746	0.0720	0.1566	0.1916	0.8175
0.70	0.092307	1.9889	0.0702	0.1395	0.2606	0.5354
0.90	********	2.0724	0.0722	0.1497	0.2296	0.6521
1.10	0.100863	2.1645	0.0690	0.1494	0.1954	0.7650
1.30	********	2.2073	0.0711	0.1569	0.1794	0.8745
1.50	0.013931	1.8996	0.0701	0.1333	0.2938	0.4535
1.70	********	2.2652	0.0736	0.1667	0.1579	1.0557
1.90	0.0	1.9792	0.0723	0.1431	0.2642	0.5414
2.15	********	2.1586	0.0743	0.1603	0.1976	0.8116
2.45	0.0	2.0829	0.0710	0.1480	0.2257	0.6557
2.75	********	1.9897	0.0710	0.1412	0.2603	0.5424
3.05	0.033819	1.7606	0.0695	0.1224	0.3455	0.3543
3.35	********	2.3885	0.0713	0.1703	0.1121	1.5196

Rep. 2, Time: 2403600 s, C0: 544 cpm/100g
Average Bulk Density................2.0878 g/cc
Average Gravimetric Water Content...0.0714 g/g
Average Volumetric Water Content....0.1491 cc/cc
Average Porosity....................0.2239 cc/cc
Average Saturation..................0.7162 cc/cc

50% BENTONITE

Low Bulk Density

X (cm)	C / C0	Bulk Density (g/cc)	Water Content		Porosity (cc/cc)	Saturation (cc/cc)
			Gravimetric (g/g)	Volumetric (cc/cc)		
-4.80	0.925229	0.8980	0.6724	0.6038	0.6699	0.9013
-4.25	0.981355	0.9092	0.6929	0.6300	0.6657	0.9463
-3.75	0.858220	1.0372	0.5976	0.6199	0.6187	1.0020
-3.25	1.134832	0.7885	0.8099	0.6386	0.7101	0.8992
-2.75	0.929452	0.9233	0.6847	0.6322	0.6605	0.9571
-2.25	0.890572	0.8840	0.6842	0.6049	0.6750	0.8962
-1.75	0.812395	0.9155	0.6860	0.6280	0.6634	0.9467
-1.25	0.764349	0.9003	0.6879	0.6193	0.6690	0.9257
-0.75	0.667617	0.9190	0.6783	0.6234	0.6621	0.9415
-0.25	0.585779	0.8956	0.6792	0.6083	0.6707	0.9069
0.25	0.428039	0.9106	0.6852	0.6239	0.6652	0.9379
0.75	0.334488	0.9230	0.6873	0.6344	0.6607	0.9602
1.25	0.250967	0.8973	0.6869	0.6163	0.6701	0.9197
1.75	0.181243	0.8599	0.7106	0.6110	0.6839	0.8935
2.25	0.124389	0.8851	0.7138	0.6318	0.6746	0.9365
2.75	0.079911	0.9461	0.6733	0.6370	0.6522	0.9768
3.25	0.050670	0.9011	0.6964	0.6276	0.6687	0.9385
3.75	0.025379	0.9604	0.6349	0.6097	0.6469	0.9425
4.25	0.016084	0.9235	0.6829	0.6306	0.6605	0.9547
4.80	0.009133	0.9493	0.6615	0.6280	0.6510	0.9647

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Rep. 1,  Time:  2583900 s, C0:    1957 cpm/g
Average Bulk Density................0.9113 g/cc
Average Gravimetric Water Content...0.6853 g/g
Average Volumetric Water Content....0.6229 cc/cc
Average Porosity....................0.6649 cc/cc
Average Saturation..................0.9374 cc/cc
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50% BENTONITE

Low Bulk Density

X (cm)	C / C0	Bulk Density (g/cc)	Water Content Gravimetric (g/g)	Water Content Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.75	1.118172	0.9031*	0.9396*	0.8486*	0.6*808	1.2*03
-4.25	0.987708	0.9280	0.6800	0.6310	0.6588	0.9578
-3.75	0.960029	0.9443	0.6810	0.6430	0.6528	0.9850
-3.25	0.951966	0.8838	0.6837	0.6043	0.6751	0.8951
-2.75	0.916037	0.9119	0.6869	0.6264	0.6647	0.9423
-2.25	0.857409	0.9202	0.6780	0.6239	0.6617	0.9430
-1.75	0.865578	0.9281	0.6738	0.6253	0.6588	0.9492
-1.25	0.754642	0.8902	0.6859	0.6106	0.6727	0.9076
-0.75	0.661409	0.9229	0.6791	0.6268	0.6607	0.9487
-0.25	0.540535	0.9158	0.6784	0.6212	0.6633	0.9366
0.25	0.403524	0.8644	0.6693	0.5785	0.6822	0.8480
0.75	0.312582	0.9288	0.6809	0.6324	0.6585	0.9604
1.25	0.235382	0.9075	0.6781	0.6153	0.6664	0.9234
1.75	0.165880	0.9145	0.6875	0.6287	0.6638	0.9471
2.25	0.114916	0.8881	0.6801	0.6040	0.6735	0.8969
2.75	0.071886	0.9520	0.6767	0.6442	0.6500	0.9911
3.25	0.048571	0.9050	0.6780	0.6136	0.6673	0.9196
3.75	0.027242	0.9075	0.6776	0.6149	0.6664	0.9227
4.25	0.016405	0.9206	0.6724	0.6190	0.6615	0.9357
4.80	0.009853	0.8824	0.6689	0.5902	0.6756	0.8736

Rep. 2, Time: 2585700 s, C0: 2073 cpm/g
Average Bulk Density................0.9002 g/cc
Average Gravimetric Water Content...0.7223 g/g
Average Volumetric Water Content....0.6409 cc/cc
Average Porosity....................0.6691 cc/cc
Average Saturation..................0.9554 cc/cc

* Values not included in averages because of spilled oven-dry soil.

50% BENTONITE

Med. Bulk Density

X (cm)	C / C0	Bulk Density (g/cc)	Water Content Gravimetric (g/g)	 Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.80	0.939472	1.2083	0.3557	0.4297	0.5558	0.7732
-4.25	0.977533	1.3457	0.3498	0.4707	0.5052	0.9317
-3.75	1.004576	1.3315	0.3509	0.4672	0.5105	0.9152
-3.25	0.987116	1.3413	0.3618	0.4852	0.5069	0.9573
-2.75	0.986080	1.3364	0.3499	0.4676	0.5087	0.9192
-2.25	0.937466	1.3651	0.3452	0.4713	0.4981	0.9462
-1.75	0.890530	1.3049	0.3571	0.4660	0.5202	0.8956
-1.25	0.804194	1.3455	0.3588	0.4828	0.5053	0.9554
-0.75	0.705758	1.3138	0.3628	0.4766	0.5170	0.9220
-0.25	0.551261	1.3814	0.3502	0.4838	0.4921	0.9830
0.25	0.468978	1.3599	0.3460	0.4706	0.5000	0.9410
0.75	0.285659	1.3336	0.3606	0.4809	0.5097	0.9435
1.25	0.201298	1.2891	0.3688	0.4755	0.5261	0.9038
1.75	0.126637	1.3125	0.3602	0.4728	0.5175	0.9137
2.25	0.061621	1.3035	0.3695	0.4817	0.5208	0.9249
2.75	0.057912	1.3190	0.3727	0.4916	0.5151	0.9544
3.25	0.020033	1.2846	0.3736	0.4799	0.5277	0.9094
3.75	0.007585	1.3326	0.3575	0.4764	0.5101	0.9340
4.25	0.004906	1.3477	0.3619	0.4878	0.5045	0.9668
4.85	0.001333	1.2589	0.3559	0.4480	0.5372	0.8341

Rep. 1, Time: 3367800 s, C0: 658 cpm/g
Average Bulk Density................1.3208 g/cc
Average Gravimetric Water Content...0.3584 g/g
Average Volumetric Water Content....0.4733 cc/cc
Average Porosity....................0.5144 cc/cc
Average Saturation..................0.9212 cc/cc

50% BENTONITE

Med. Bulk Density

X (cm)	C / C0	Bulk Density (g/cc)	Water Content Gravimetric (g/g)	Water Content Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-5.00	0.958383	1.2403	0.3527	0.4374	0.5440	0.8041
-4.45	1.034350	1.3567	0.3460	0.4694	0.5012	0.9365
-3.95	1.020040	1.3543	0.3493	0.4731	0.5021	0.9422
-3.45	1.067562	1.3134	0.3452	0.4534	0.5171	0.8767
-2.95	0.983738	1.3963	0.3431	0.4791	0.4867	0.9844
-2.40	0.872315	1.3522	0.3426	0.4632	0.5029	0.9212
-1.85	0.924705	1.3689	0.3407	0.4665	0.4967	0.9391
-1.35	0.850584	1.3400	0.3555	0.4764	0.5073	0.9391
-0.85	0.731874	1.3335	0.3441	0.4588	0.5097	0.9001
-0.30	0.530712	1.3434	0.3325	0.4466	0.5061	0.8825
0.25	0.417238	1.2213	0.3333	0.4070	0.5510	0.7387
0.75	0.292914	1.3394	0.3447	0.4617	0.5076	0.9097
1.25	0.200527	1.3288	0.3522	0.4680	0.5115	0.9150
1.75	0.130179	1.3242	0.3606	0.4775	0.5132	0.9305
2.25	0.077571	1.2942	0.3690	0.4775	0.5242	0.9110
2.75	0.040907	1.3664	0.3509	0.4795	0.4977	0.9634
3.25	0.018673	1.3831	0.3423	0.4735	0.4915	0.9634
3.75	0.009093	1.3604	0.3434	0.4671	0.4999	0.9345
4.25	0.005340	1.3941	0.3448	0.4807	0.4875	0.9861
4.80	0.002595	1.2874	0.3408	0.4387	0.5267	0.8329

Rep. 2, Time: 3370500 s, C0: 628 cpm/g
Average Bulk Density................1.3349 g/cc
Average Gravimetric Water Content...0.3467 g/g
Average Volumetric Water Content....0.4628 cc/cc
Average Porosity....................0.5092 cc/cc
Average Saturation..................0.9105 cc/cc

50% BENTONITE

High Bulk Density

X (cm)	C / CO	Bulk Density (g/cc)	Water Content Gravimetric (g/g)	 Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-3.35	********	2.3001	0.1171	0.2694	0.1544	1.7453
-3.05	1.060044	1.6065	0.1165	0.1872	0.4094	0.4573
-2.75	********	1.9524	0.1159	0.2264	0.2822	0.8022
-2.45	1.106410	1.9445	0.1221	0.2374	0.2851	0.8327
-2.15	********	1.8752	0.1214	0.2276	0.3106	0.7329
-1.90	0.996380	1.9541	0.1186	0.2318	0.2816	0.8231
-1.70	********	1.8769	0.1189	0.2232	0.3099	0.7202
-1.50	0.927985	1.9712	0.1179	0.2325	0.2753	0.8446
-1.30	********	1.9088	0.1208	0.2305	0.2982	0.7729
-1.10	0.950319	1.9846	0.1217	0.2416	0.2704	0.8936
-0.90	********	1.8571	0.1180	0.2192	0.3173	0.6908
-0.70	0.898229	1.9891	0.1207	0.2401	0.2687	0.8937
-0.50	0.838382	1.9602	0.1241	0.2432	0.2794	0.8706
-0.30	0.759050	1.9014	0.1236	0.2350	0.3010	0.7809
-0.10	0.551277	1.8818	0.1299	0.2445	0.3082	0.7933
0.10	0.412987	1.9140	0.1239	0.2372	0.2963	0.8004
0.30	0.375089	1.8539	0.1244	0.2306	0.3184	0.7242
0.50	0.141464	1.9361	0.1251	0.2421	0.2882	0.8402
0.70	0.091033	1.9331	0.1215	0.2348	0.2893	0.8117
0.90	********	1.9127	0.1241	0.2373	0.2968	0.7996
1.10	0.085853	1.8844	0.1197	0.2255	0.3072	0.7340
1.30	********	1.9672	0.1243	0.2445	0.2768	0.8832
1.50	0.106008	1.9010	0.1240	0.2356	0.3011	0.7826
1.70	********	1.9990	0.1257	0.2513	0.2651	0.9481
1.90	0.0	1.7797	0.1266	0.2253	0.3457	0.6517
2.15	********	1.9291	0.1252	0.2415	0.2908	0.8306
2.45	0.030118	1.9790	0.1257	0.2487	0.2724	0.9130
2.75	********	1.9264	0.1258	0.2423	0.2918	0.8306
3.05	0.020595	1.8375	0.1271	0.2335	0.3245	0.7195
3.35	********	1.7918	0.1231	0.2205	0.3413	0.6461

```
Rep. 1,  Time:  2406120 s, CO:      634 cpm/100g
Average Bulk Density................1.9170 g/cc
Average Gravimetric Water Content...0.1224 g/g
Average Volumetric Water Content....0.2347 cc/cc
Average Porosity....................0.2952 cc/cc
Average Saturation..................0.8190 cc/cc
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50% BENTONITE

High Bulk Density

X (cm)	C / C0	Bulk Density (g/cc)	Water Content		Porosity (cc/cc)	Saturation (cc/cc)
			Gravimetric (g/g)	Volumetric (cc/cc)		
-3.35	********	1.8410	0.1180	0.2173	0.3231	0.6725
-3.05	0.926987	1.9463	0.1192	0.2321	0.2844	0.8158
-2.75	********	1.8435	0.1200	0.2212	0.3222	0.6863
-2.45	0.934955	2.0815	0.1200	0.2499	0.2347	1.0645
-2.15	********	1.7886	0.1207	0.2159	0.3424	0.6305
-1.90	0.997552	1.8195	0.1224	0.2227	0.3311	0.6727
-1.70	********	2.0260	0.1225	0.2481	0.2551	0.9726
-1.50	1.035502	2.0078	0.1238	0.2486	0.2619	0.9494
-1.30	********	1.8368	0.1200	0.2204	0.3247	0.6789
-1.10	1.035085	2.0374	0.1201	0.2446	0.2510	0.9748
-0.90	********	1.8438	0.1230	0.2268	0.3221	0.7042
-0.70	0.933001	1.8511	0.1234	0.2284	0.3194	0.7151
-0.50	0.846797	1.9608	0.1182	0.2318	0.2791	0.8304
-0.30	0.740851	1.8945	0.1192	0.2258	0.3035	0.7441
-0.10	0.609683	1.9785	0.1244	0.2461	0.2726	0.9027
0.10	0.391662	1.8008	0.1293	0.2329	0.3379	0.6890
0.30	0.171986	1.9061	0.1193	0.2274	0.2992	0.7598
0.50	0.179221	1.9400	0.1201	0.2330	0.2868	0.8126
0.70	0.207714	2.0087	0.1175	0.2360	0.2615	0.9024
0.90	********	1.8213	0.1179	0.2147	0.3304	0.6498
1.10	0.040277	1.9731	0.1181	0.2330	0.2746	0.8487
1.30	********	1.9831	0.1186	0.2353	0.2709	0.8685
1.50	0.026744	1.8572	0.1183	0.2197	0.3172	0.6927
1.70	********	1.9029	0.1181	0.2248	0.3004	0.7482
1.90	0.029414	1.9782	0.1188	0.2350	0.2727	0.8617
2.15	********	1.9681	0.1172	0.2306	0.2764	0.8343
2.45	0.0	1.8565	0.1151	0.2137	0.3175	0.6731
2.75	********	1.8670	0.1155	0.2157	0.3136	0.6878
3.05	0.051980	1.7291	0.1126	0.1946	0.3643	0.5343
3.35	********	2.2860	0.1174	0.2684	0.1595	1.6821

Rep. 2, Time: 2415000 s, C0: 634 cpm/100g
Average Bulk Density................1.9212 g/cc
Average Gravimetric Water Content...0.1196 g/g
Average Volumetric Water Content....0.2298 cc/cc
Average Porosity....................0.2937 cc/cc
Average Saturation..................0.8086 cc/cc

75% BENTONITE

Low Bulk Density

X (cm)	C / CO	Bulk Density (g/cc)	Water Content Gravimetric (g/g)	Water Content Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.80	0.850942	0.8510	0.7593	0.6462	0.6894	0.9372
-4.25	0.945552	0.8366	0.7976	0.6673	0.6947	0.9606
-3.75	1.015527	0.8005	0.7946	0.6361	0.7078	0.8987
-3.25	0.908107	0.8158	0.8179	0.6673	0.7022	0.9502
-2.75	0.970446	0.8144	0.8205	0.6682	0.7028	0.9508
-2.25	0.838157	0.8237	0.8130	0.6697	0.6994	0.9576
-1.75	0.773814	0.8179	0.8223	0.6726	0.7015	0.9588
-1.25	0.764342	0.8025	0.8258	0.6627	0.7071	0.9373
-0.75	0.641210	0.8102	0.8205	0.6648	0.7043	0.9438
-0.25	0.593063	0.7630	0.8033	0.6129	0.7215	0.8495
0.25	0.473640	0.8285	0.8393	0.6954	0.6976	0.9969
0.75	0.394473	0.8073	0.8396	0.6778	0.7054	0.9608
1.25	0.279480	0.7726	0.8493	0.6561	0.7180	0.9138
1.75	0.208552	0.8204	0.8528	0.6996	0.7006	0.9986
2.25	0.134514	0.7951	0.8435	0.6707	0.7098	0.9448
2.75	0.098399	0.7835	0.8527	0.6681	0.7141	0.9356
3.25	0.060289	0.7916	0.8531	0.6753	0.7111	0.9497
3.75	0.037759	0.7954	0.8494	0.6756	0.7097	0.9519
4.25	0.023775	0.7835	0.8394	0.6577	0.7141	0.9210
4.80	0.014900	0.8196	0.8124	0.6658	0.7009	0.9500

Rep. 1, Time: 2584800 s, C0: 2536 cpm/g
Average Bulk Density................0.8067 g/cc
Average Gravimetric Water Content...0.8253 g/g
Average Volumetric Water Content....0.6655 cc/cc
Average Porosity....................0.7056 cc/cc
Average Saturation..................0.9434 cc/cc

75% BENTONITE

Low Bulk Density

X (cm)	C / C0	Bulk Density (g/cc)	Water Content Gravimetric (g/g)	Water Content Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.80	0.996317	0.8093	0.7809	0.6320	0.7046	0.8969
-4.25	0.951929	0.8325	0.8134	0.6771	0.6962	0.9726
-3.75	0.947889	0.8018	0.8183	0.6561	0.7074	0.9275
-3.25	0.907011	0.8101	0.8181	0.6627	0.7043	0.9409
-2.75	0.895143	0.8204	0.8143	0.6680	0.7006	0.9535
-2.25	0.864011	0.8215	0.8198	0.6735	0.7002	0.9618
-1.75	0.803005	0.8033	0.8052	0.6468	0.7068	0.9151
-1.25	0.738687	0.8359	0.8274	0.6916	0.6949	0.9952
-0.75	0.626372	0.7927	0.8149	0.6460	0.7107	0.9089
-0.25	0.535317	0.8064	0.7895	0.6367	0.7057	0.9022
0.30	0.461025	0.7934	0.8360	0.6633	0.7104	0.9336
0.85	0.391533	0.8113	0.8581	0.6962	0.7039	0.9891
1.35	0.283496	0.7747	0.8570	0.6640	0.7172	0.9257
1.85	0.200256	0.8064	0.8596	0.6933	0.7057	0.9824
2.35	0.129222	0.7739	0.8682	0.6719	0.7175	0.9364
2.85	0.085820	0.7810	0.8508	0.6645	0.7149	0.9294
3.35	0.054474	0.8009	0.8661	0.6936	0.7077	0.9801
3.85	0.036028	0.7656	0.8607	0.6589	0.7206	0.9144
4.35	0.021842	0.7910	0.8476	0.6704	0.7113	0.9425
4.85	0.017451	0.7300	0.5291	0.3862	0.7336	0.5265

Rep. 2, Time: 2586600 s, C0: 2514 cpm/g
Average Bulk Density................0.7981 g/cc
Average Gravimetric Water Content...0.8167 g/g
Average Volumetric Water Content....0.6526 cc/cc
Average Porosity....................0.7087 cc/cc
Average Saturation..................0.9217 cc/cc

75% BENTONITE

Med. Bulk Density

X	C / C0	Bulk Density	Water Content		Porosity	Saturation
(cm)		(g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	(cc/cc)	(cc/cc)
-4.80	0.922422	1.1882	0.4388	0.5214	0.5664	0.9206
-4.25	0.992129	1.2336	0.4407	0.5437	0.5498	0.9889
-3.75	1.022815	1.1820	0.4471	0.5285	0.5686	0.9295
-3.25	1.009510	1.2049	0.4457	0.5370	0.5603	0.9585
-2.75	1.004468	1.1768	0.4494	0.5289	0.5705	0.9271
-2.25	0.942230	1.1882	0.4457	0.5295	0.5664	0.9349
-1.75	0.868564	1.1883	0.4377	0.5202	0.5663	0.9185
-1.25	0.789342	1.1978	0.4435	0.5312	0.5628	0.9438
-0.75	0.694656	1.1796	0.4503	0.5311	0.5695	0.9327
-0.25	0.575979	1.1521	0.4336	0.4995	0.5795	0.8619
0.25	0.402704	1.1968	0.4417	0.5286	0.5632	0.9386
0.75	0.256467	1.2006	0.4450	0.5342	0.5618	0.9509
1.25	0.207403	1.1958	0.4376	0.5233	0.5636	0.9285
1.75	0.142910	1.1740	0.4472	0.5250	0.5715	0.9186
2.25	0.078609	1.2170	0.4336	0.5277	0.5558	0.9495
2.75	0.041425	1.2469	0.4208	0.5247	0.5449	0.9628
3.25	0.022504	1.2223	0.4223	0.5162	0.5539	0.9320
3.75	0.010236	1.2322	0.4201	0.5176	0.5503	0.9406
4.25	0.004247	1.2307	0.4307	0.5300	0.5508	0.9623
4.80	0.003016	1.1349	0.4231	0.4802	0.5858	0.8198

Rep. 1, Time: 3369600 s, C0: 867 cpm/g
Average Bulk Density................1.1971 g/cc
Average Gravimetric Water Content...0.4377 g/g
Average Volumetric Water Content....0.5239 cc/cc
Average Porosity....................0.5631 cc/cc
Average Saturation..................0.9310 cc/cc

75% BENTONITE

Med. Bulk Density

X (cm)	C / C0	Bulk Density (g/cc)	Water Content Gravimetric (g/g)	Water Content Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.80	0.939868	1.0934	0.4346	0.4752	0.6010	0.7907
-4.25	0.971106	1.2029	0.4439	0.5339	0.5610	0.9517
-3.75	1.001540	1.2070	0.4446	0.5366	0.5595	0.9592
-3.25	0.988422	1.2038	0.4415	0.5315	0.5606	0.9479
-2.75	0.975283	1.1950	0.4440	0.5306	0.5639	0.9410
-2.25	0.925377	1.2032	0.4468	0.5376	0.5609	0.9585
-1.75	0.858276	1.1983	0.4434	0.5313	0.5627	0.9443
-1.25	0.765933	1.1723	0.4419	0.5181	0.5722	0.9055
-0.75	0.701722	1.2033	0.4457	0.5363	0.5609	0.9563
-0.25	0.620347	1.1081	0.4377	0.4850	0.5956	0.8144
0.25	0.412057	1.2443	0.4431	0.5513	0.5459	1.0100
0.75	0.295390	1.1942	0.4396	0.5249	0.5642	0.9304
1.25	0.205000	1.1965	0.4485	0.5366	0.5633	0.9526
1.75	0.130431	1.2309	0.4241	0.5220	0.5508	0.9477
2.25	0.077819	1.2141	0.4316	0.5240	0.5569	0.9410
2.75	0.043639	1.2118	0.4312	0.5225	0.5577	0.9369
3.25	0.020557	1.2075	0.4346	0.5248	0.5593	0.9384
3.75	0.012266	1.1898	0.4370	0.5199	0.5658	0.9190
4.25	0.005456	1.2375	0.4350	0.5384	0.5483	0.9818
4.80	0.002958	1.1388	0.4298	0.4895	0.5844	0.8377

Rep. 2, Time: 3370500 s, C0: 890 cpm/g
Average Bulk Density................1.1926 g/cc
Average Gravimetric Water Content...0.4389 g/g
Average Volumetric Water Content....0.5235 cc/cc
Average Porosity....................0.5647 cc/cc
Average Saturation..................0.9282 cc/cc

75% BENTONITE

High Bulk Density

X (cm)	C / C0	Bulk Density (g/cc)	Water Content		Porosity (cc/cc)	Saturation (cc/cc)
			Gravimetric (g/g)	Volumetric (cc/cc)		
-3.30	********	2.1768	0.2228	0.4850	0.2055	2.3594
-3.10	1.010929	1.3338	0.2231	0.2975	0.5132	0.5798
-2.85	********	1.5311	0.2247	0.3441	0.4412	0.7799
-2.55	1.011742	1.6555	0.2304	0.3814	0.3958	0.9635
-2.25	********	1.5474	0.2321	0.3592	0.4352	0.8253
-2.00	1.007841	1.7792	0.2327	0.4141	0.3506	1.1808
-1.80	********	1.6725	0.2359	0.3946	0.3896	1.0129
-1.60	1.011804	1.5515	0.2327	0.3610	0.4338	0.8322
-1.40	********	1.5940	0.2343	0.3735	0.4183	0.8929
-1.20	0.894375	1.6701	0.2387	0.3987	0.3905	1.0210
-1.00	********	1.6162	0.2441	0.3945	0.4101	0.9619
-0.80	0.848640	1.6726	0.2428	0.4061	0.3896	1.0426
-0.60	0.676280	1.4048	0.2406	0.3379	0.4873	0.6935
-0.40	0.711465	1.7793	0.2455	0.4368	0.3506	1.2459
-0.20	0.630154	1.3240	0.2361	0.3126	0.5168	0.6048
0.0	0.490867	1.7907	0.2305	0.4128	0.3465	1.1914
0.20	0.382877	1.8027	0.2304	0.4154	0.3421	1.2144
0.40	0.315278	1.4708	0.2320	0.3412	0.4632	0.7365
0.60	0.218415	1.5268	0.2324	0.3548	0.4428	0.8012
0.80	********	1.7542	0.2361	0.4142	0.3598	1.1514
1.00	0.122015	1.6811	0.2309	0.3881	0.3865	1.0043
1.20	********	1.7557	0.2212	0.3883	0.3592	1.0810
1.40	0.092112	1.5027	0.2212	0.3325	0.4516	0.7362
1.60	********	1.7405	0.2217	0.3858	0.3648	1.0577
1.80	0.0	1.5974	0.2215	0.3539	0.4170	0.8486
2.00	********	1.6968	0.2204	0.3740	0.3807	0.9824
2.25	0.001759	1.6694	0.2208	0.3685	0.3907	0.9431
2.55	********	1.6687	0.2143	0.3576	0.3910	0.9146
2.85	0.003910	1.7163	0.2191	0.3761	0.3736	1.0066
3.15	********	1.5422	0.2102	0.3241	0.4372	0.7415

Rep. 1, Time: 2416800 s, C0: 1430 cpm/100g
Average Bulk Density................1.6408 g/cc
Average Gravimetric Water Content...0.2293 g/g
Average Volumetric Water Content....0.3761 cc/cc
Average Porosity....................0.4012 cc/cc
Average Saturation..................0.9802 cc/cc

75% BENTONITE

High Bulk Density

X	C / C0	Bulk Density	Water Content		Porosity	Saturation
(cm)		(g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	(cc/cc)	(cc/cc)
-3.35	********	2.0573	0.2356	0.4848	0.2492	1.9457
-3.05	0.943092	1.2947	0.2378	0.3079	0.5275	0.5837
-2.75	********	1.5874	0.2489	0.3951	0.4207	0.9392
-2.45	0.958987	1.5904	0.2467	0.3924	0.4196	0.9352
-2.15	********	1.5524	0.2454	0.3809	0.4334	0.8789
-1.90	0.976637	1.5996	0.2470	0.3952	0.4162	0.9495
-1.70	********	1.5566	0.2540	0.3954	0.4319	0.9156
-1.50	0.964692	1.5536	0.2604	0.4046	0.4330	0.9344
-1.30	********	1.5725	0.2552	0.4013	0.4261	0.9417
-1.10	0.942652	1.5345	0.2544	0.3903	0.4400	0.8871
-0.90	********	1.5837	0.2548	0.4035	0.4220	0.9562
-0.70	0.860645	1.4643	0.2560	0.3749	0.4656	0.8053
-0.50	0.822753	1.5891	0.2781	0.4419	0.4200	1.0520
-0.30	0.648093	1.6514	0.2555	0.4220	0.3973	1.0621
-0.10	0.567892	1.5633	0.2419	0.3782	0.4295	0.8806
0.10	0.404554	1.6439	0.2325	0.3822	0.4000	0.9554
0.30	0.370854	1.5252	0.2403	0.3665	0.4433	0.8266
0.50	0.336335	1.6799	0.2363	0.3970	0.3869	1.0260
0.70	0.192746	1.7203	0.2269	0.3904	0.3722	1.0490
0.90	********	1.5191	0.2360	0.3585	0.4456	0.8047
1.10	0.179818	1.7075	0.2361	0.4031	0.3768	1.0697
1.30	********	1.6298	0.2351	0.3832	0.4052	0.9457
1.50	0.025212	1.6221	0.2329	0.3778	0.4080	0.9260
1.70	********	1.6388	0.2374	0.3890	0.4019	0.9680
1.90	0.015585	1.6148	0.2353	0.3800	0.4106	0.9255
2.15	********	1.6376	0.2347	0.3844	0.4023	0.9555
2.45	0.0	1.5959	0.2386	0.3808	0.4175	0.9121
2.75	********	1.6519	0.2320	0.3832	0.3971	0.9650
3.05	0.037212	1.6457	0.2342	0.3854	0.3994	0.9650
3.30	********	0.9919	0.2306	0.2287	0.6380	0.3585

Rep. 2, Time: 2482200 s, C0: 1430 cpm/100g
Average Bulk Density................1.5858 g/cc
Average Gravimetric Water Content...0.2430 g/g
Average Volumetric Water Content....0.3853 cc/cc
Average Porosity....................0.4212 cc/cc
Average Saturation..................0.9440 cc/cc

100% BENTONITE

Low Bulk Density

X (cm)	C / C0	Bulk Density (g/cc)	Water Content Gravimetric (g/g)	Water Content Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.80	0.868520	0.4835	1.4962	0.7234	0.8255	0.8763
-4.25	0.970456	0.5057	1.5090	0.7630	0.8175	0.9334
-3.75	0.993113	0.5198	1.5144	0.7872	0.8123	0.9690
-3.25	0.957005	0.5160	1.5170	0.7828	0.8137	0.9620
-2.75	0.886225	0.5135	1.5138	0.7773	0.8146	0.9542
-2.25	0.835098	0.5075	1.5472	0.7851	0.8168	0.9612
-1.75	0.824684	0.5140	1.5055	0.7738	0.8145	0.9500
-1.25	0.779008	0.5126	1.6240	0.8324	0.8150	1.0214
-0.75	0.682164	0.5200	1.3562	0.7052	0.8123	0.8682
-0.25	0.579116	0.5598	1.4722	0.8242	0.7979	1.0329
0.25	0.448404	0.5451	1.4721	0.8024	0.8032	0.9989
0.75	0.354296	0.5217	1.4779	0.7710	0.8117	0.9498
1.25	0.267775	0.5123	1.4730	0.7546	0.8151	0.9258
1.75	0.186346	0.5307	1.4720	0.7812	0.8084	0.9664
2.25	0.136392	0.5279	1.4732	0.7777	0.8094	0.9609
2.75	0.097549	0.5199	1.4787	0.7687	0.8123	0.9463
3.25	0.057884	0.5259	1.4871	0.7820	0.8102	0.9653
3.75	0.038882	0.5149	1.4876	0.7659	0.8141	0.9408
4.25	0.027132	0.5276	1.4867	0.7843	0.8095	0.9688
4.75	0.019552	0.5403	1.5013	0.8111	0.8050	1.0077

Rep. 1, Time: 2590200 s, C0: 4548 cpm/g
Average Bulk Density................0.5209 g/cc
Average Gravimetric Water Content...1.4932 g/g
Average Volumetric Water Content....0.7777 cc/cc
Average Porosity....................0.8119 cc/cc
Average Saturation..................0.9580 cc/cc

100% BENTONITE

Low Bulk Density

			Water Content			
X (cm)	C / C0	Bulk Density (g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.80	0.971557	0.4971	1.4798	0.7356	0.8205	0.8965
-4.25	0.945144	0.5298	1.4658	0.7766	0.8087	0.9603
-3.75	0.977748	0.5202	1.4685	0.7639	0.8122	0.9406
-3.25	0.968089	0.5158	1.4706	0.7585	0.8138	0.9321
-2.75	0.888073	0.5261	1.4713	0.7740	0.8101	0.9554
-2.25	0.895723	0.5235	1.4841	0.7769	0.8110	0.9579
-1.75	0.826478	0.5159	1.4888	0.7680	0.8138	0.9438
-1.25	0.720727	0.5165	1.4805	0.7647	0.8135	0.9399
-0.75	0.652188	0.5167	1.4920	0.7709	0.8135	0.9476
-0.25	0.572389	0.5268	1.5107	0.7959	0.8098	0.9828
0.25	0.405654	0.5293	1.4972	0.7924	0.8089	0.9796
0.75	0.339378	0.5100	1.4997	0.7649	0.8159	0.9375
1.25	0.270203	0.5105	1.5053	0.7684	0.8157	0.9420
1.75	0.198466	0.5136	1.4989	0.7698	0.8146	0.9450
2.25	0.139464	0.5163	1.4998	0.7744	0.8136	0.9518
2.75	0.094056	0.5281	1.4988	0.7915	0.8093	0.9780
3.25	0.061407	0.5046	1.4939	0.7539	0.8178	0.9218
3.75	0.041207	0.5180	1.4923	0.7729	0.8130	0.9507
4.25	0.026661	0.4992	1.4962	0.7469	0.8198	0.9111
4.80	0.019325	0.4867	1.4961	0.7282	0.8243	0.8834

Rep. 2, Time: 2591100 s, C0: 4626 cpm/g
Average Bulk Density................0.5152 g/cc
Average Gravimetric Water Content...1.4895 g/g
Average Volumetric Water Content....0.7674 cc/cc
Average Porosity....................0.8140 cc/cc
Average Saturation..................0.9429 cc/cc

100% BENTONITE

Med. Bulk Density

X (cm)	C / C0	Bulk Density (g/cc)	Water Content Gravimetric (g/g)	Water Content Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.80	0.983386	1.1492	0.5352	0.6150	0.5851	1.0511
-4.25	1.039110	1.0768	0.5419	0.5835	0.6113	0.9546
-3.75	1.024956	1.0870	0.5493	0.5970	0.6076	0.9826
-3.25	1.050399	1.0597	0.5453	0.5778	0.6174	0.9358
-2.75	0.983917	1.0761	0.5502	0.5921	0.6115	0.9682
-2.25	0.989246	1.0609	0.5611	0.5952	0.6170	0.9647
-1.75	0.916216	0.9842	0.5565	0.5478	0.6447	0.8496
-1.25	0.804895	1.1500	0.5384	0.6192	0.5848	1.0587
-0.75	0.689045	1.0729	0.5372	0.5764	0.6127	0.9408
-0.25	0.525948	1.1400	0.5305	0.6048	0.5885	1.0277
0.25	0.408144	1.0036	0.5378	0.5397	0.6377	0.8463
0.75	0.288941	1.0888	0.5434	0.5917	0.6069	0.9749
1.25	0.172286	1.0362	0.5469	0.5667	0.6259	0.9054
1.80	0.088280	1.0852	0.5424	0.5886	0.6082	0.9677
2.30	0.049509	1.0825	0.5417	0.5864	0.6092	0.9625
2.75	0.025110	1.0454	0.5527	0.5778	0.6226	0.9281
3.25	0.011403	1.1013	0.5456	0.6009	0.6024	0.9975
3.75	0.005260	1.0704	0.5394	0.5774	0.6136	0.9410
4.25	0.002858	1.0842	0.5421	0.5877	0.6086	0.9657
4.80	0.001448	0.9970	0.5480	0.5463	0.6401	0.8536

Rep. 1, Time: 3027600 s, C0: 1080 cpm/g
Average Bulk Density................1.0726 g/cc
Average Gravimetric Water Content...0.5443 g/g
Average Volumetric Water Content....0.5836 cc/cc
Average Porosity....................0.6128 cc/cc
Average Saturation..................0.9538 cc/cc

100% BENTONITE

Med. Bulk Density

X (cm)	C / CO	Bulk Density (g/cc)	Water Content Gravimetric (g/g)	Water Content Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-4.85	0.915766	1.0258	0.5322	0.5459	0.6297	0.8670
-4.25	1.032290	1.1303	0.5324	0.6018	0.5920	1.0166
-3.75	1.070862	1.0388	0.5517	0.5731	0.6250	0.9169
-3.25	1.011285	1.0762	0.5364	0.5773	0.6115	0.9440
-2.75	0.997869	1.0910	0.5367	0.5855	0.6061	0.9661
-2.25	0.996618	1.1008	0.5277	0.5808	0.6026	0.9639
-1.75	0.932468	1.0935	0.5281	0.5775	0.6052	0.9542
-1.25	0.802634	1.0791	0.5306	0.5726	0.6104	0.9380
-0.75	0.753670	1.0696	0.5393	0.5768	0.6139	0.9396
-0.25	0.589141	1.1838	0.5217	0.6176	0.5726	1.0785
0.25	0.380990	0.9147	0.5450	0.4985	0.6698	0.7442
0.75	0.270302	1.0457	0.5444	0.5692	0.6225	0.9145
1.25	0.177552	1.0667	0.5523	0.5891	0.6149	0.9581
1.75	0.103429	1.0612	0.5576	0.5917	0.6169	0.9592
2.25	0.056159	1.0525	0.5616	0.5911	0.6200	0.9533
2.75	0.026486	1.0655	0.5549	0.5912	0.6153	0.9608
3.25	0.012587	1.0896	0.5475	0.5966	0.6066	0.9835
3.75	0.005842	1.0697	0.5395	0.5771	0.6138	0.9402
4.25	0.002224	1.1091	0.5376	0.5963	0.5996	0.9944
4.80	0.001046	1.1009	0.5403	0.5948	0.6026	0.9872

Rep. 2, Time: 3029400 s, CO: 1094 cpm/g
Average Bulk Density................1.0732 g/cc
Average Gravimetric Water Content...0.5409 g/g
Average Volumetric Water Content....0.5802 cc/cc
Average Porosity....................0.6126 cc/cc
Average Saturation..................0.9490 cc/cc

100% BENTONITE

High Bulk Density

X (cm)	C / C0	Bulk Density (g/cc)	Water Content Gravimetric (g/g)	Water Content Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-3.35	********	1.6578	0.2521	0.4180	0.4015	1.0411
-3.05	0.698902	1.3734	0.2599	0.3570	0.5042	0.7080
-2.75	********	1.4245	0.2642	0.3764	0.4857	0.7749
-2.45	0.761495	1.5612	0.2661	0.4155	0.4364	0.9521
-2.15	********	1.4616	0.2656	0.3881	0.4724	0.8217
-1.90	0.879359	1.5185	0.2649	0.4023	0.4518	0.8904
-1.70	********	1.5060	0.2666	0.4015	0.4563	0.8798
-1.50	0.920579	1.5161	0.2674	0.4054	0.4527	0.8956
-1.30	********	1.5405	0.2668	0.4110	0.4439	0.9260
-1.10	1.001791	1.4832	0.2662	0.3949	0.4645	0.8501
-0.90	********	1.5372	0.2589	0.3980	0.4451	0.3942
-0.70	0.947714	1.5311	0.2628	0.4024	0.4473	0.8996
-0.50	0.845987	1.4320	0.2617	0.3747	0.4830	0.7758
-0.30	0.795331	1.5764	0.2628	0.4143	0.4309	0.9616
-0.10	0.597147	1.4900	0.2630	0.3919	0.4621	0.8482
0.10	0.402764	1.5047	0.2623	0.3947	0.4568	0.8641
0.30	0.321244	1.5418	0.2574	0.3968	0.4434	0.8949
0.50	0.147442	1.3631	0.2601	0.3545	0.5079	0.6980
0.70	0.132948	1.5819	0.2626	0.4154	0.4289	0.9685
0.90	********	1.4605	0.2620	0.3827	0.4727	0.8095
1.10	0.036008	1.4343	0.2654	0.3806	0.4822	0.7893
1.30	********	1.6971	0.2679	0.4547	0.3873	1.1740
1.50	0.0	1.4179	0.2668	0.3782	0.4881	0.7749
1.70	********	1.5466	0.2678	0.4141	0.4416	0.9377
1.90	0.005385	1.5020	0.2685	0.4033	0.4578	0.8810
2.15	********	1.5078	0.2674	0.4031	0.4557	0.8847
2.45	0.035471	1.4267	0.2680	0.3823	0.4849	0.7884
2.75	********	1.4739	0.2682	0.3953	0.4679	0.8448
3.05	0.0	1.5756	0.2668	0.4204	0.4312	0.9748
3.35	********	1.6033	0.2598	0.4166	0.4212	0.9891

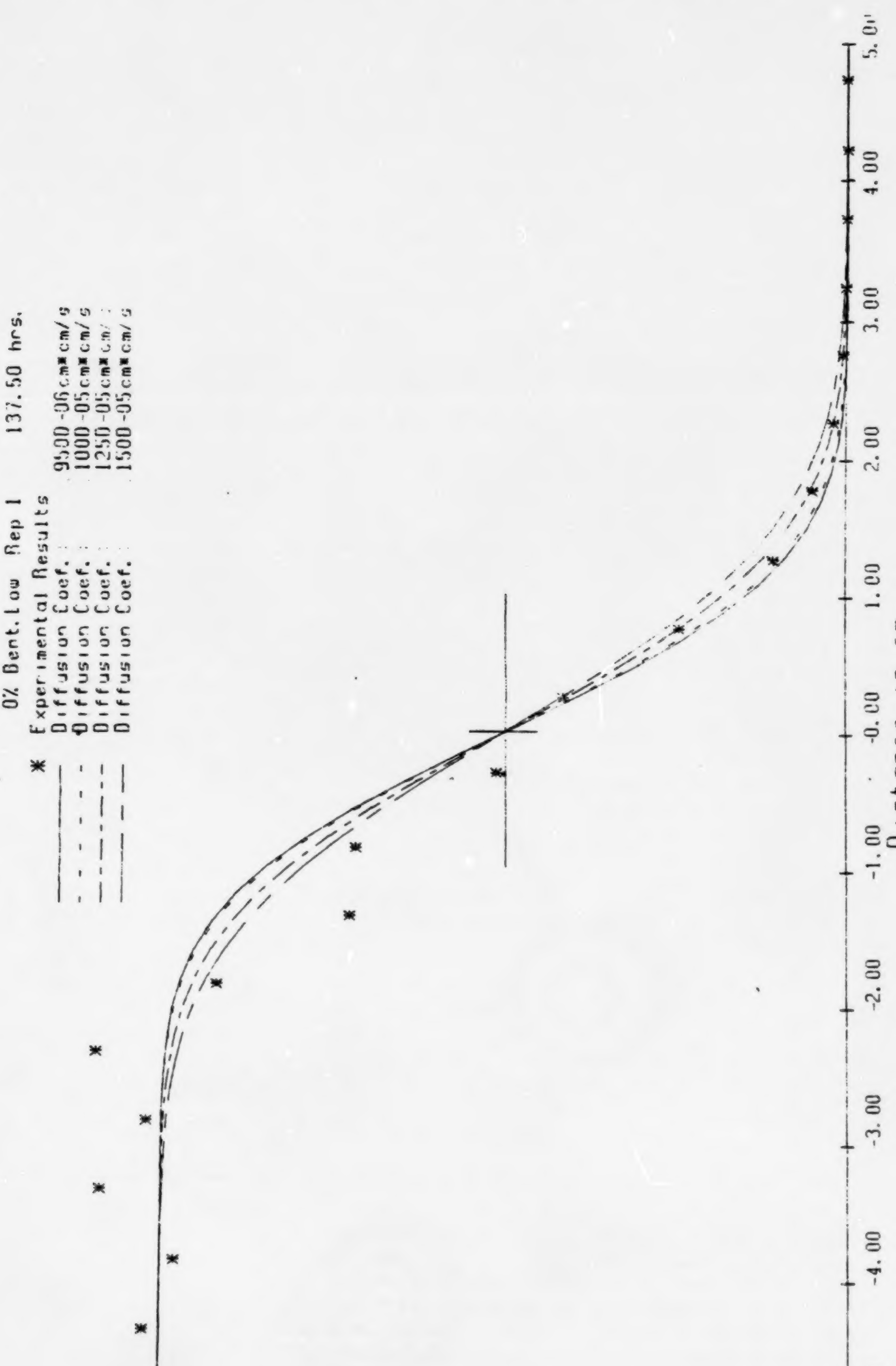
Rep. 1, Time: 2484120 s, C0: 1446 cpm/100g
Average Bulk Density................1.5082 g/cc
Average Gravimetric Water Content...0.2640 g/g
Average Volumetric Water Content....0.3981 cc/cc
Average Porosity....................0.4555 cc/cc
Average Saturation..................0.8797 cc/cc

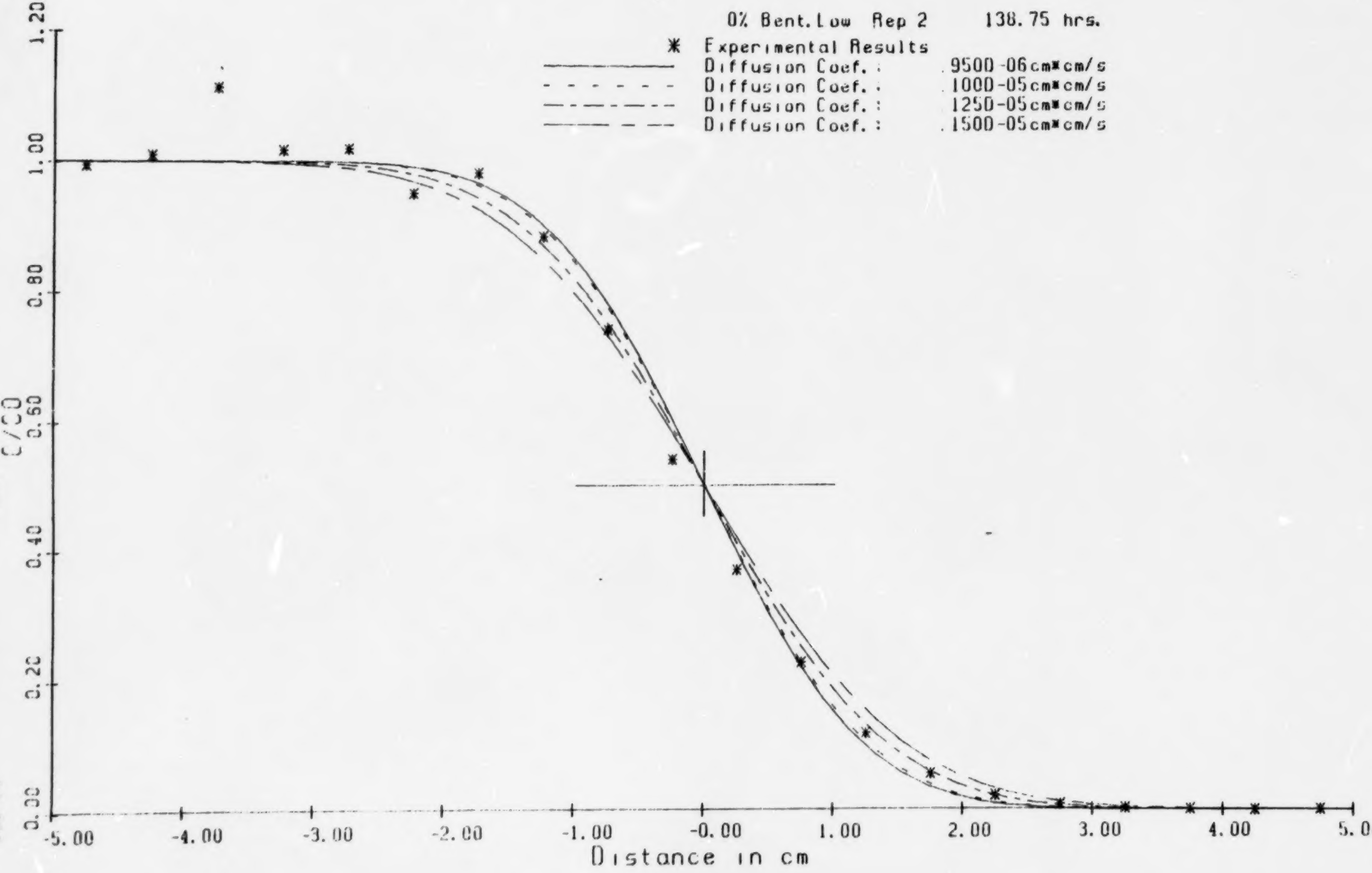
100% BENTONITE

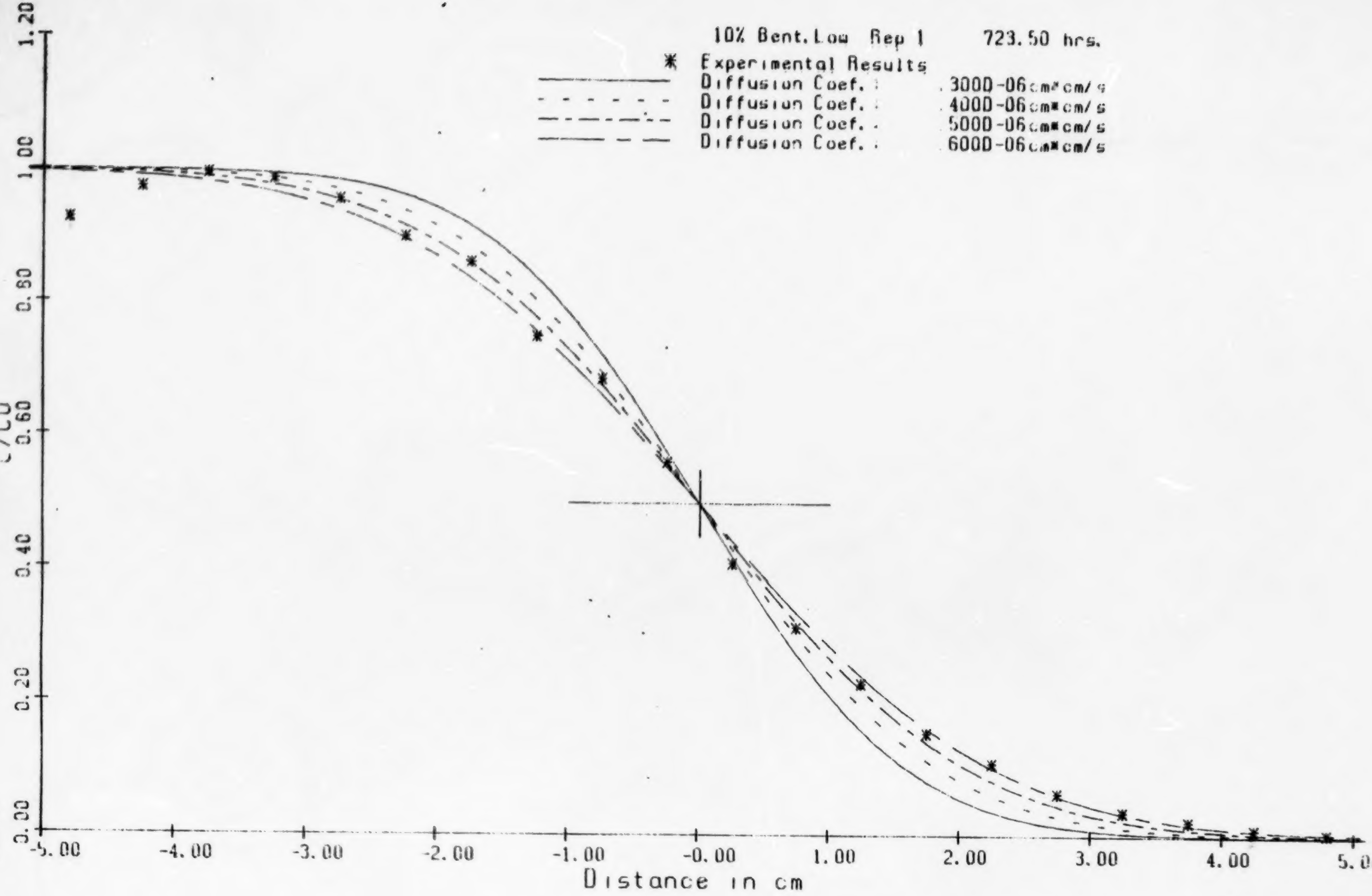
High Bulk Density

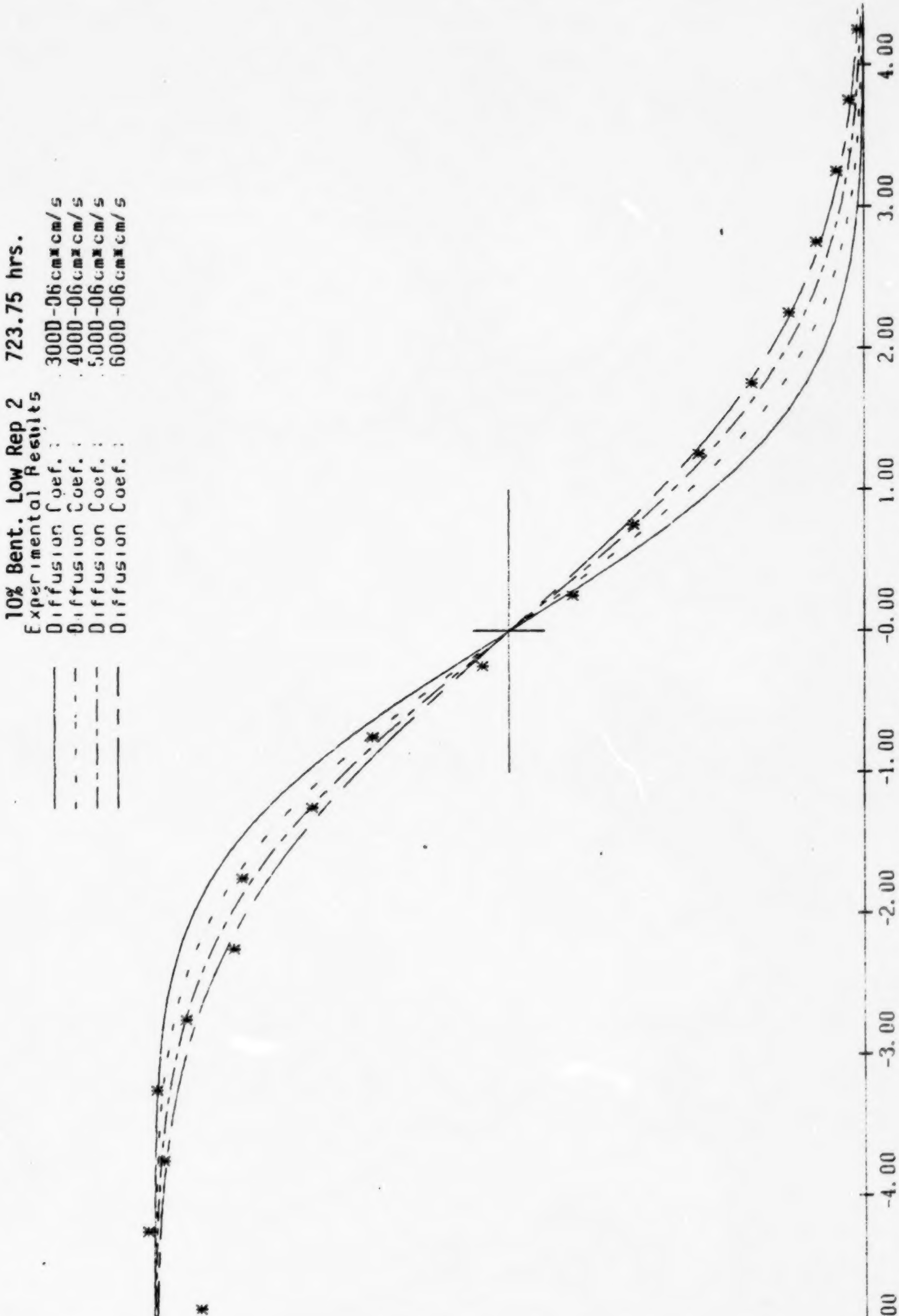
			Water Content			
X (cm)	C / C0	Bulk Density (g/cc)	Gravimetric (g/g)	Volumetric (cc/cc)	Porosity (cc/cc)	Saturation (cc/cc)
-3.35	********	1.6825	0.2749	0.4625	0.3926	1.1779
-3.05	1.036559	1.5859	0.2779	0.4407	0.4275	1.0311
-2.75	********	1.4553	0.2779	0.4045	0.4746	0.8522
-2.45	1.092015	1.4571	0.2774	0.4042	0.4740	0.8527
-2.15	********	1.5484	0.2803	0.4340	0.4410	0.9842
-1.90	1.081892	1.3199	0.2759	0.3641	0.5235	0.6956
-1.70	********	1.6770	0.2747	0.4608	0.3946	1.1677
-1.50	1.007921	1.5353	0.2756	0.4231	0.4457	0.9491
-1.30	********	1.3026	0.2728	0.3554	0.5297	0.6709
-1.10	0.904805	1.5748	0.2749	0.4330	0.4315	1.0034
-0.90	********	1.5297	0.2793	0.4272	0.4478	0.9541
-0.70	0.815182	1.4144	0.2780	0.3932	0.4894	0.8034
-0.50	0.756397	1.6584	0.2778	0.4608	0.4013	1.1481
-0.30	0.687395	1.3288	0.2773	0.3684	0.5203	0.7082
-0.10	0.437680	1.3051	0.2800	0.3655	0.5289	0.6911
0.10	0.302764	1.6482	0.2775	0.4573	0.4050	1.1293
0.30	0.257952	1.6861	0.2763	0.4658	0.3913	1.1904
0.50	0.146122	1.2988	0.2748	0.3569	0.5311	0.6720
0.70	0.045221	1.5548	0.2772	0.4310	0.4387	0.9824
0.90	********	1.3411	0.9465	1.2693	0.5159	2.4604
1.10	0.0	1.5350	0.2750	0.4221	0.4458	0.9467
1.30	********	1.5130	0.2765	0.4183	0.4538	0.9218
1.50	0.0	1.3503	0.2754	0.3719	0.5125	0.7256
1.70	********	1.6080	0.2747	0.4418	0.4195	1.0531
1.90	0.0	1.3972	0.2740	0.3828	0.4956	0.7725
2.15	********	1.5904	0.2729	0.4340	0.4258	1.0192
2.45	0.0	1.4056	0.2719	0.3822	0.4926	0.7759
2.75	********	1.5759	0.2727	0.4298	0.4311	0.9971
3.05	0.0	1.4187	0.2707	0.3841	0.4878	0.7873
3.35	********	1.4966	0.2675	0.4004	0.4597	0.8709

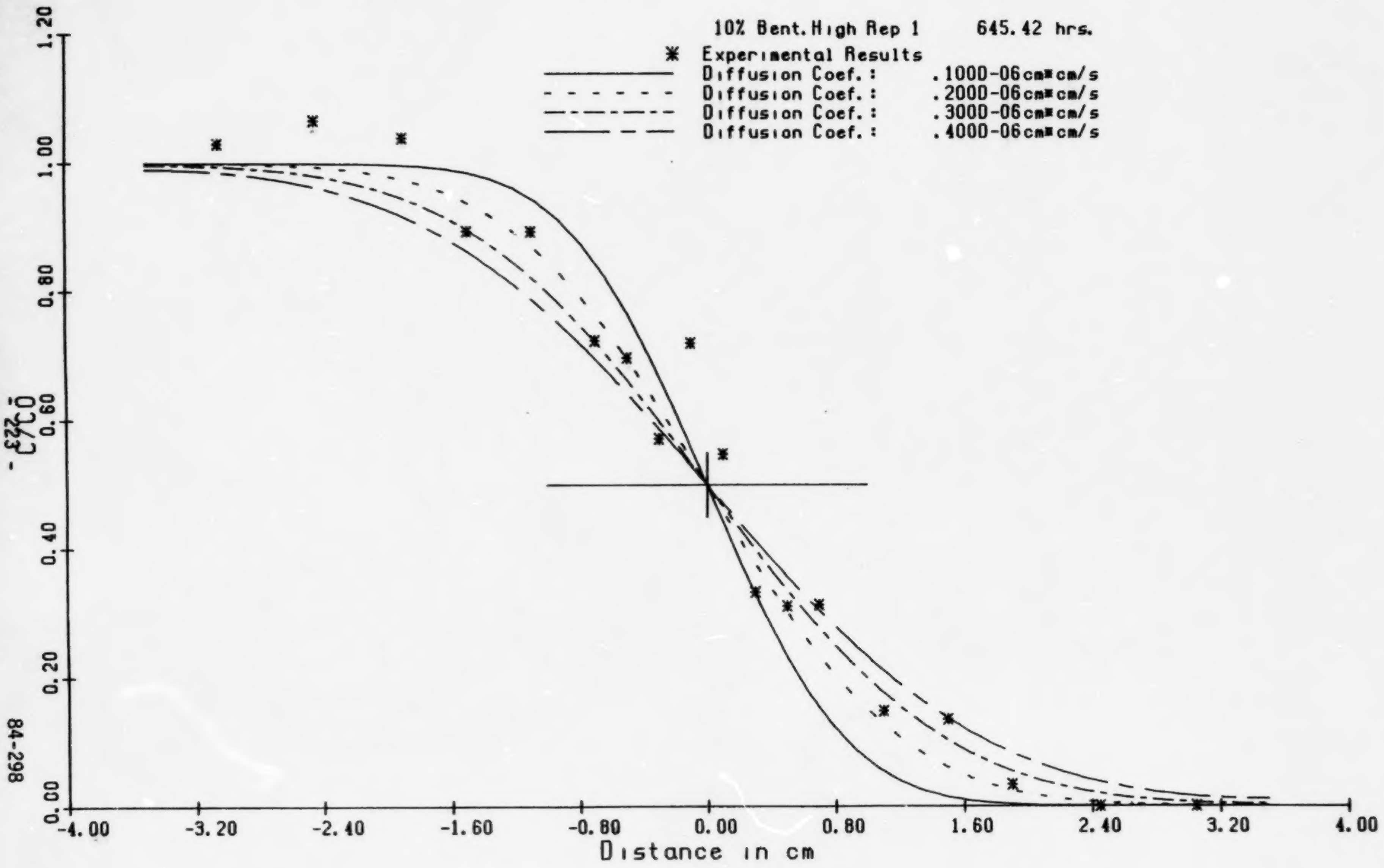
Rep. 2, Time: 2487000 s, C0: 1446 cpm/100g
Average Bulk Density................1.4932 g/cc
Average Gravimetric Water Content...0.2979 g/g
Average Volumetric Water Content....0.4415 cc/cc
Average Porosity....................0.4609 cc/cc
Average Saturation..................0.9665 cc/cc

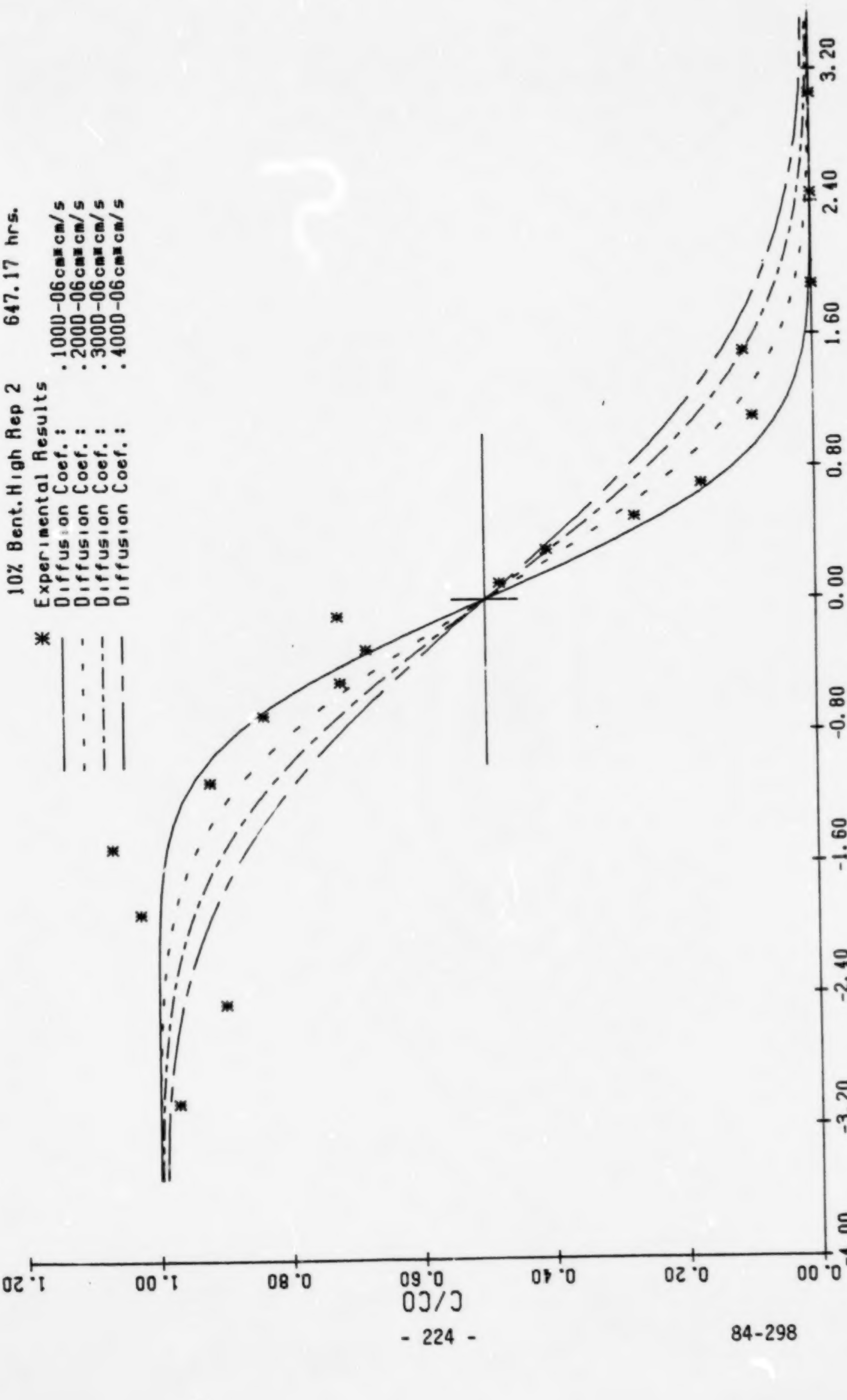

0% Bent.Low Rep 1 137.50 hrs.
Experimental Results
Diffusion Coef. 9500-06cm*cm/s
Diffusion Coef. 1000-05cm*cm/s
Diffusion Coef. 1250-05cm*cm/s
Diffusion Coef. 1500-05cm*cm/s
Distance in cm
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
0.00
0.20
0.40
0.60
0.80
1.00
1.20
C0/J


0% Bent.Low Rep 2 138.75 hrs.
* Experimental Results
Diffusion Coef.: .9500-06cm*cm/s
Diffusion Coef.: .1000-05cm*cm/s
Diffusion Coef.: .1250-05cm*cm/s
Diffusion Coef.: .1500-05cm*cm/s
C/CO
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

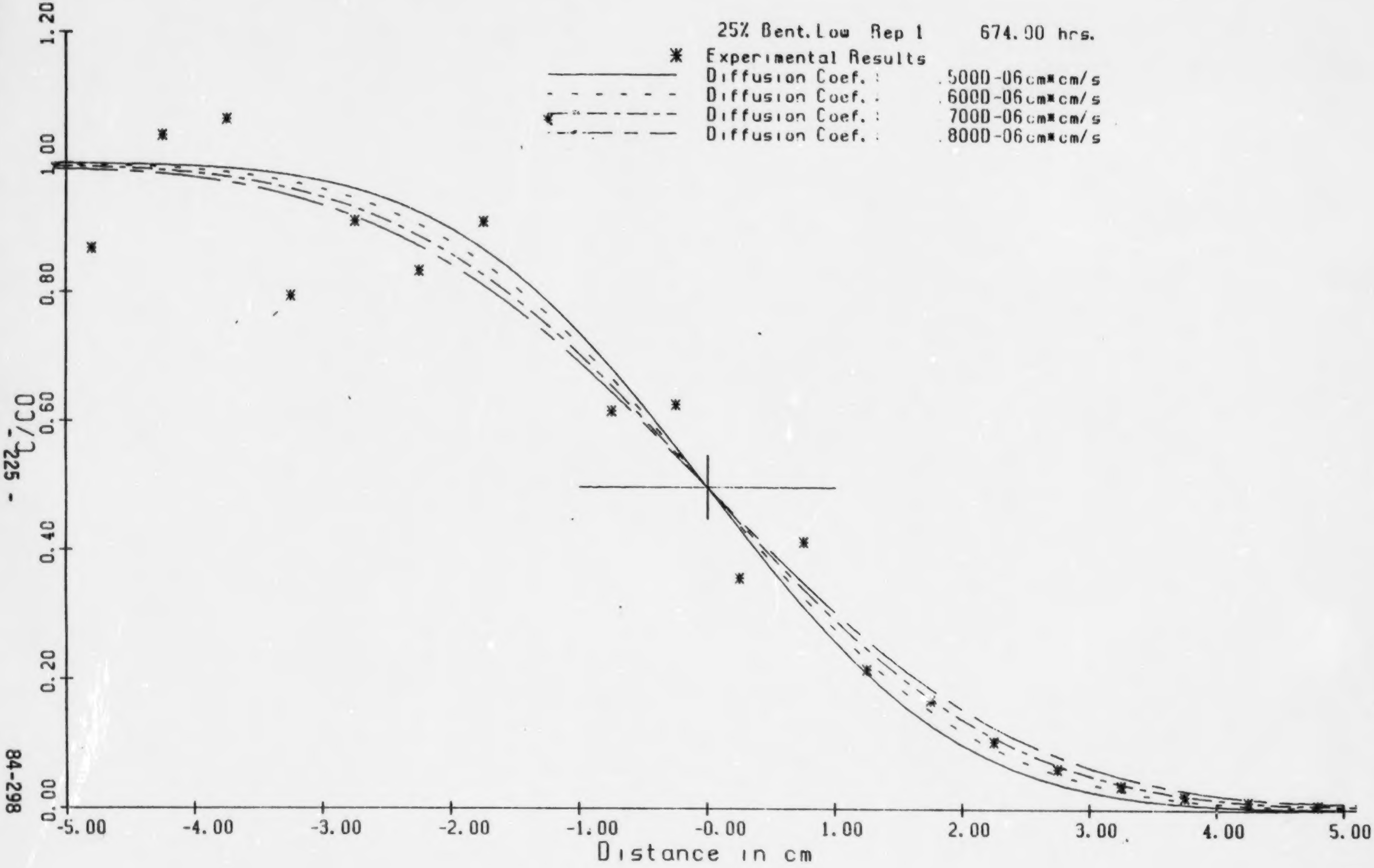

10% Bent. Low Rep 1 723.50 hrs.
Experimental Results
Diffusion Coef. : .3000-06cm*cm/s
Diffusion Coef. : .4000-06cm*cm/s
Diffusion Coef. . .5000-06cm*cm/s
Diffusion Coef. . .6000-06cm*cm/s
C/CO
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.0
Distance in cm

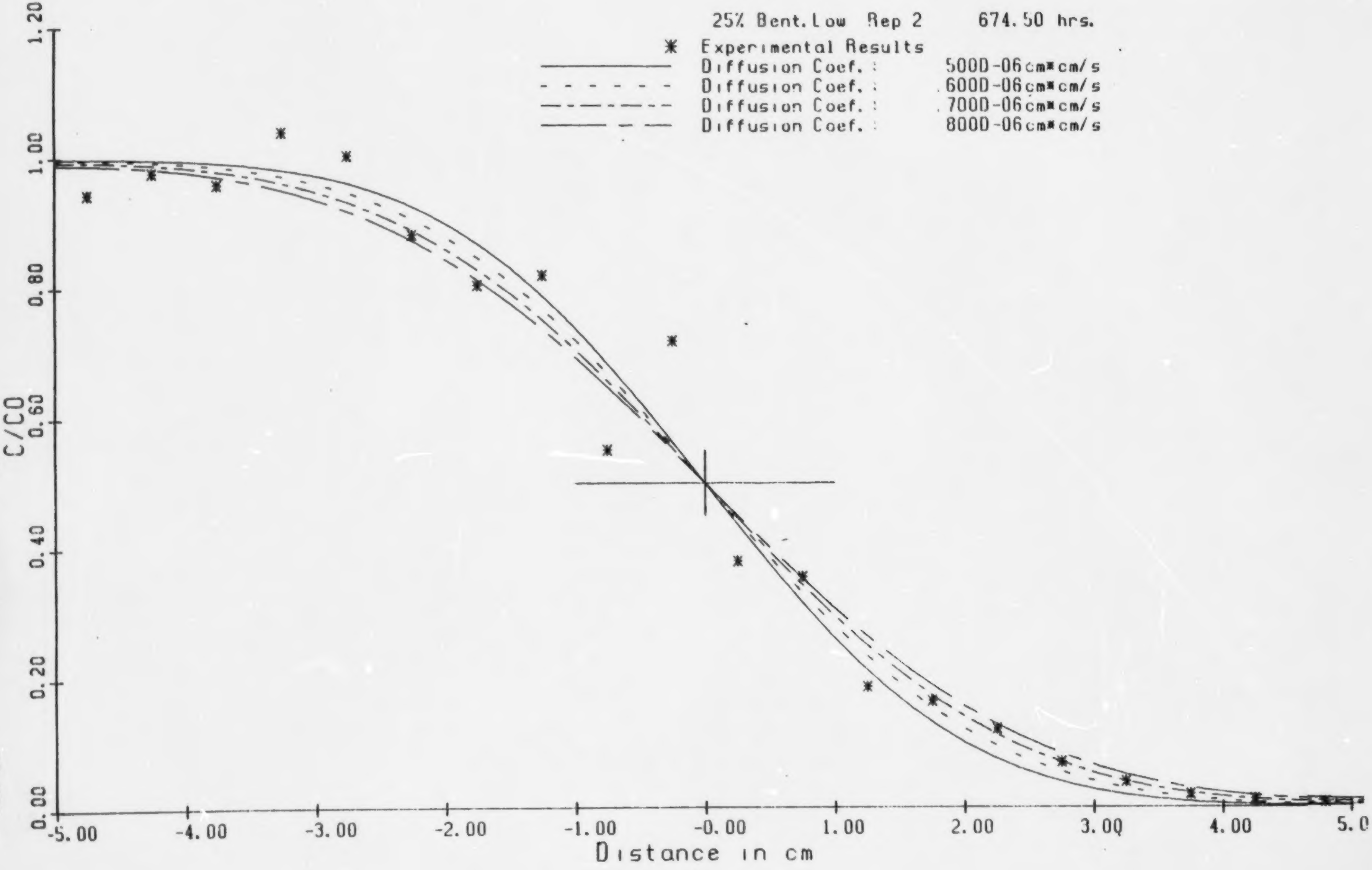

10% Bent. Low Rep 2 723.75 hrs.
Experimental Results
Diffusion Coef. : 3000D-06cm*cm/s
Diffusion Coef. : 4000D-06cm*cm/s
Diffusion Coef. : 5000D-06cm*cm/s
Diffusion Coef. : 6000D-06cm*cm/s
C/C0
1.00
0.80
0.60
0.40
0.20
0.00
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
Distance in cm

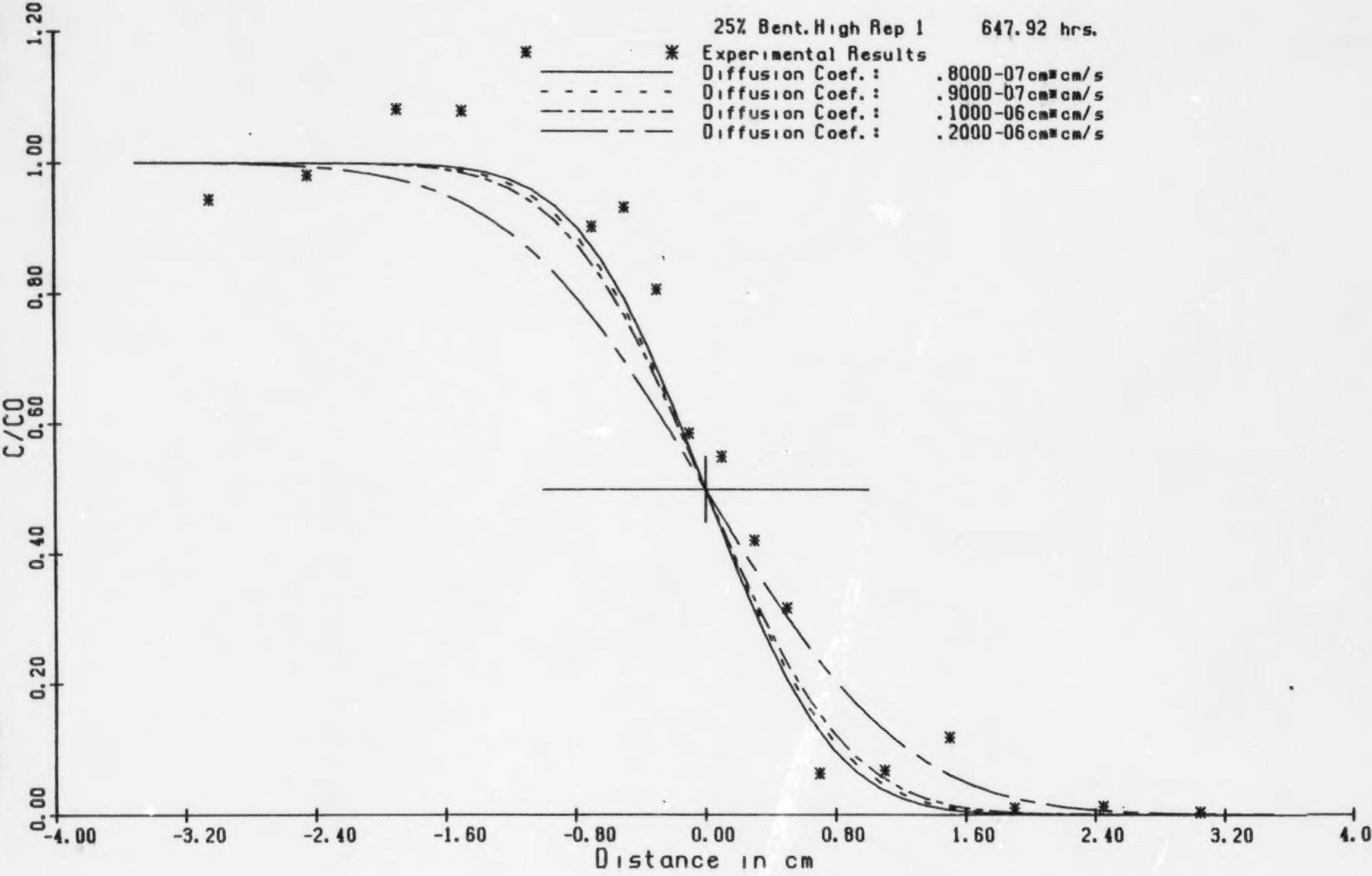

10% Bent.High Rep 1   645.42 hrs.
✱ Experimental Results
Diffusion Coef.: .1000-06cm*cm/s
Diffusion Coef.: .2000-06cm*cm/s
Diffusion Coef.: .3000-06cm*cm/s
Diffusion Coef.: .4000-06cm*cm/s
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-4.00
-3.20
-2.40
-1.60
-0.80
0.00
0.80
1.60
2.40
3.20
4.00
Distance in cm

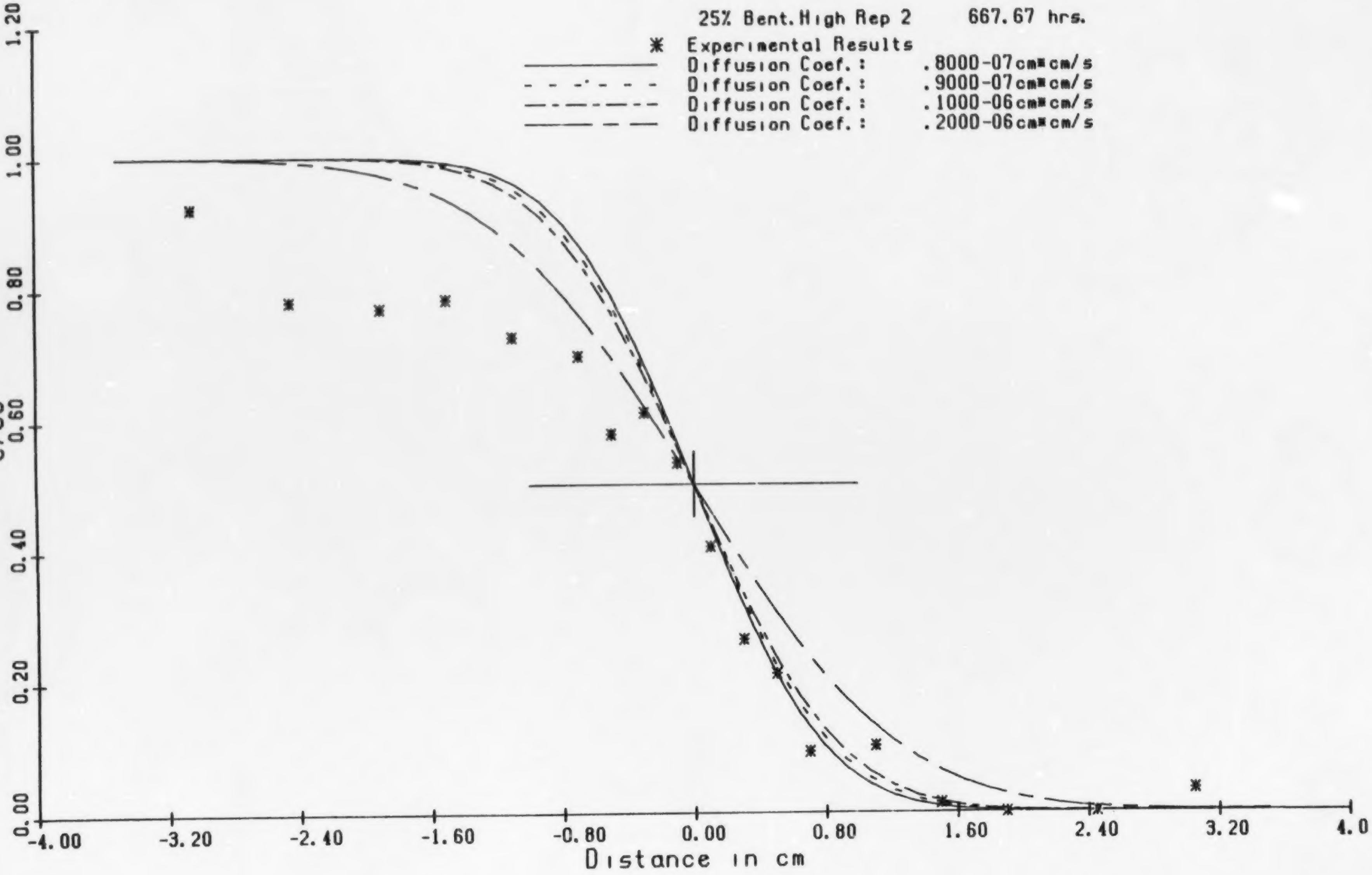


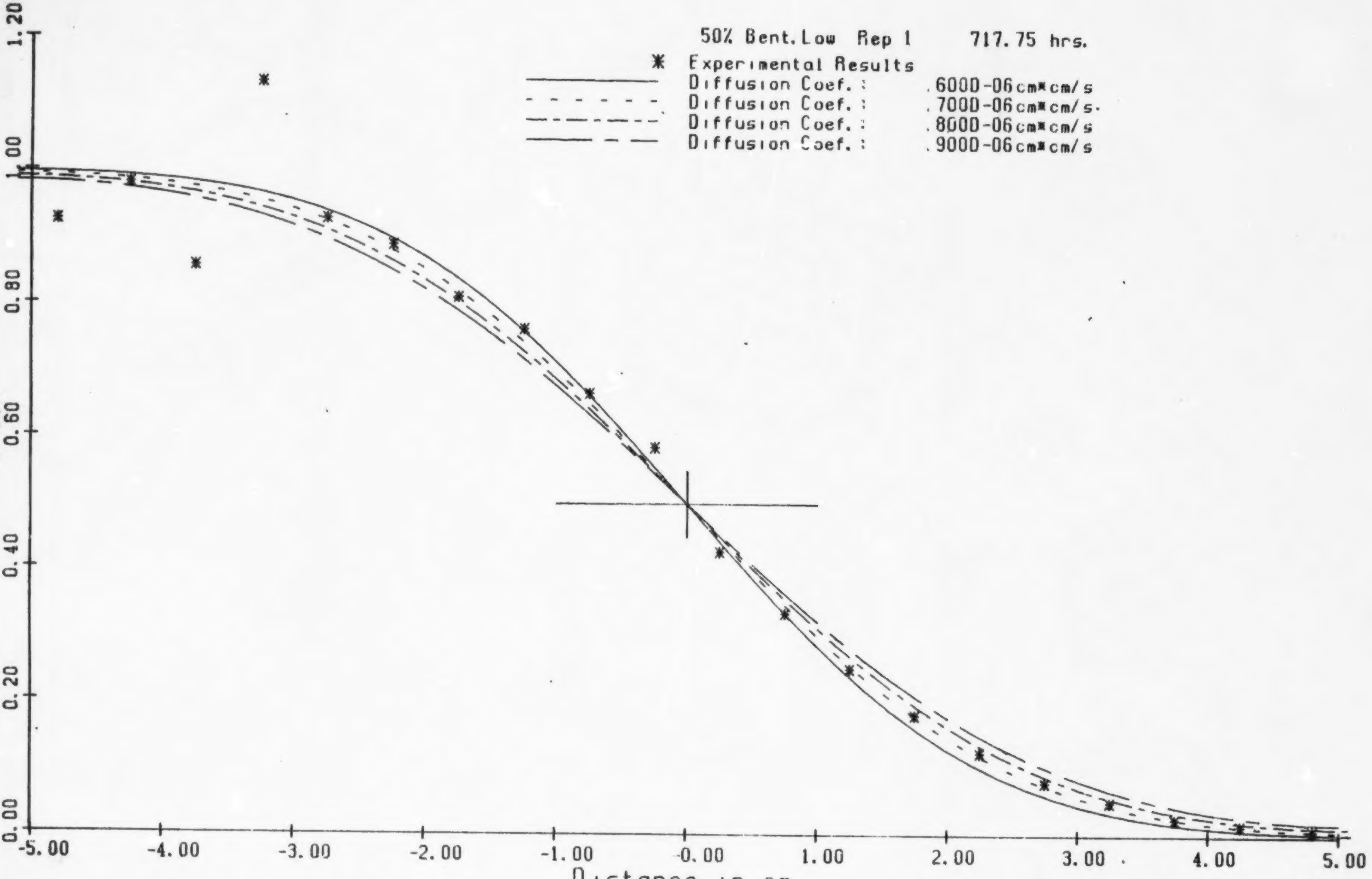
10% Bent. High Rep 2
647.17 hrs.
Experimental Results
Diffusion Coef. : .1000-06cm*cm/s
Diffusion Coef. : .2000-06cm*cm/s
Diffusion Coef. : .3000-06cm*cm/s
Diffusion Coef. : .4000-06cm*cm/s
C/CO
0.00
0.20
0.40
0.60
0.80
1.00
1.20
Distance in cm
-4.00
-3.20
-2.40
-1.60
-0.80
0.00
0.80
1.60
2.40
3.20

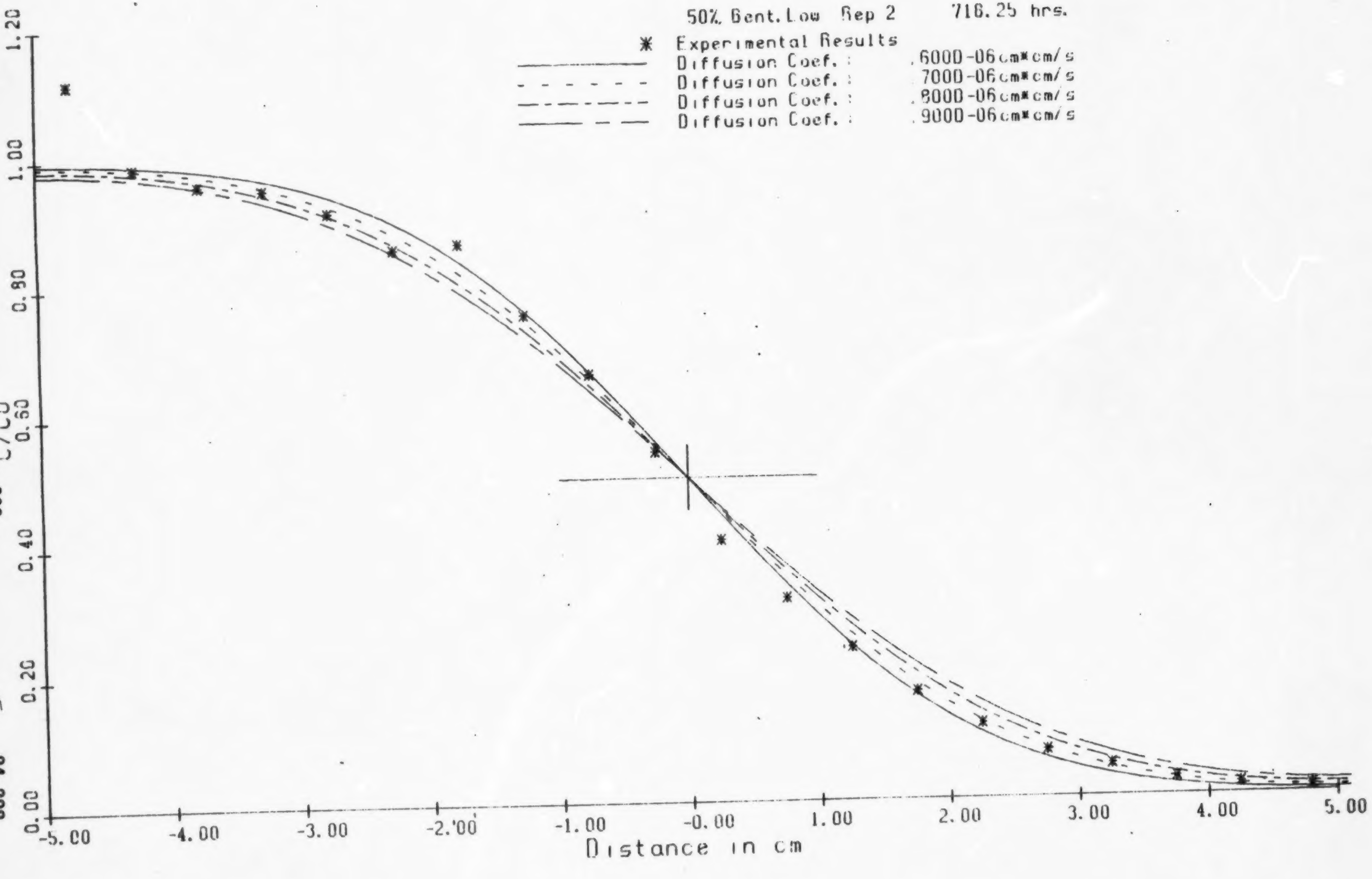

25% Bent.Low Rep 1 674.00 hrs.
✱ Experimental Results
Diffusion Coef. : .5000-06cm*cm/s
Diffusion Coef. : .6000-06cm*cm/s
Diffusion Coef. : 7000-06cm*cm/s
Diffusion Coef. : .8000-06cm*cm/s
C/CO
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

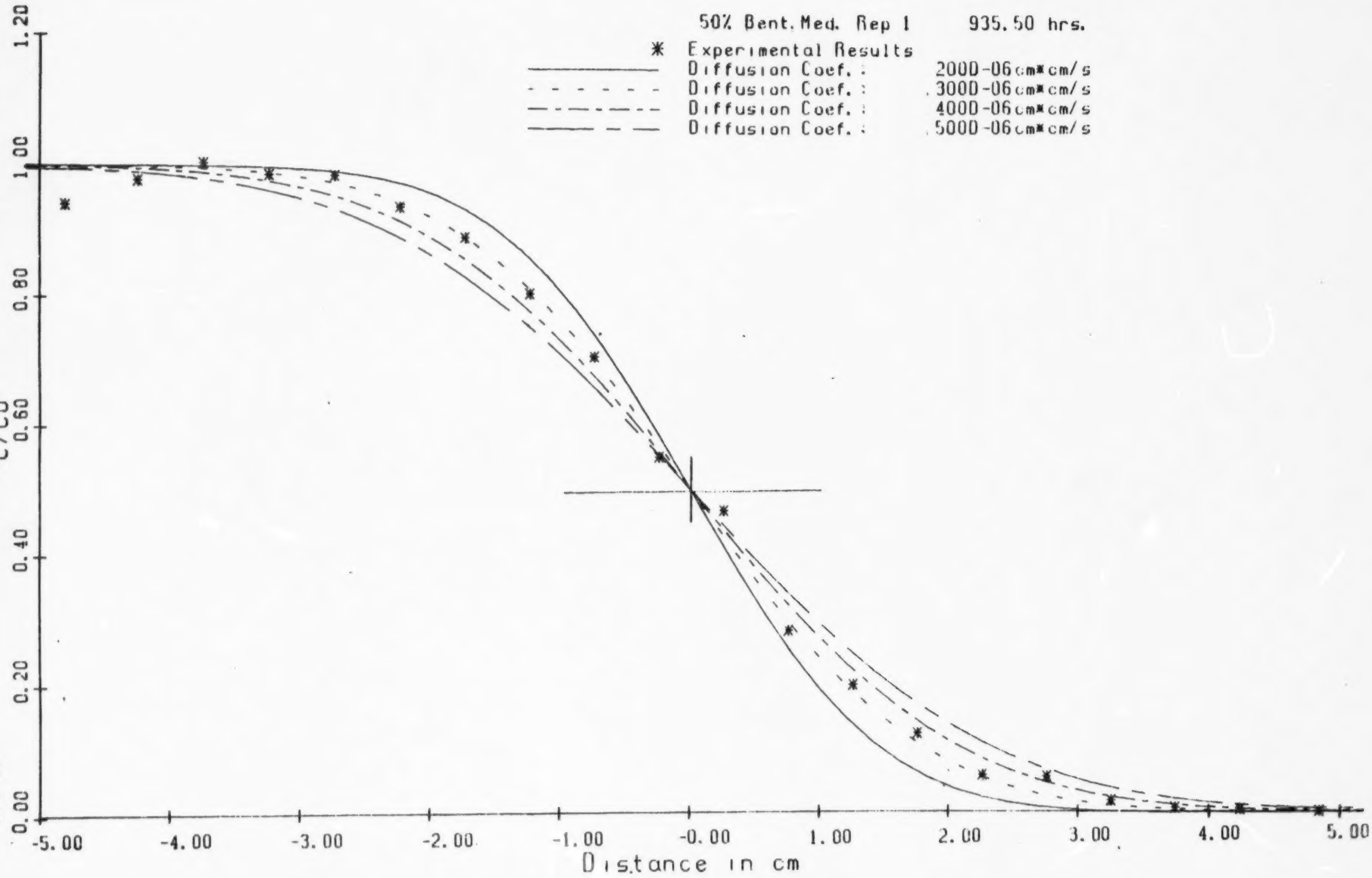

25% Bent.Low Rep 2 674.50 hrs.
✱ Experimental Results
Diffusion Coef. : 5000-06cm*cm/s
Diffusion Coef. : .6000-06cm*cm/s
Diffusion Coef. : .7000-06cm*cm/s
Diffusion Coef. : 8000-06cm*cm/s
C/CO
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.0
Distance in cm

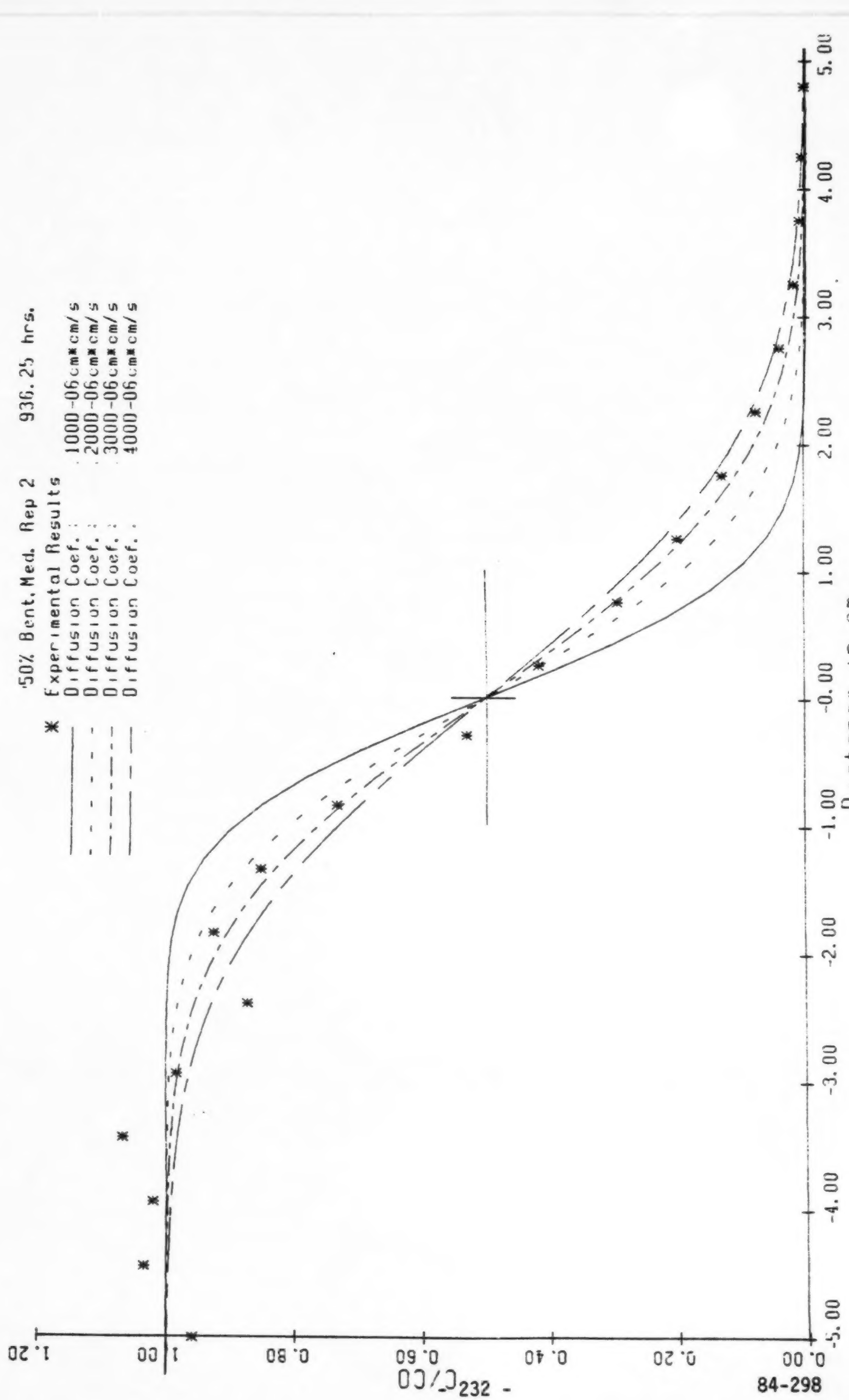

25% Bent.High Rep 1 647.92 hrs.
Experimental Results
Diffusion Coef. : .8000D-07cm*cm/s
Diffusion Coef. : .9000D-07cm*cm/s
Diffusion Coef. : .1000D-06cm*cm/s
Diffusion Coef. : .2000D-06cm*cm/s
C/CO
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-4.00
-3.20
-2.40
-1.60
-0.80
0.00
0.80
1.60
2.40
3.20
4.00
Distance in cm


25% Bent.High Rep 2 667.67 hrs.
* Experimental Results
Diffusion Coef.: .8000-07cm*cm/s
Diffusion Coef.: .9000-07cm*cm/s
Diffusion Coef.: .1000-06cm*cm/s
Diffusion Coef.: .2000-06cm*cm/s
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-4.00
-3.20
-2.40
-1.60
-0.80
0.00
0.80
1.60
2.40
3.20
4.0
Distance in cm

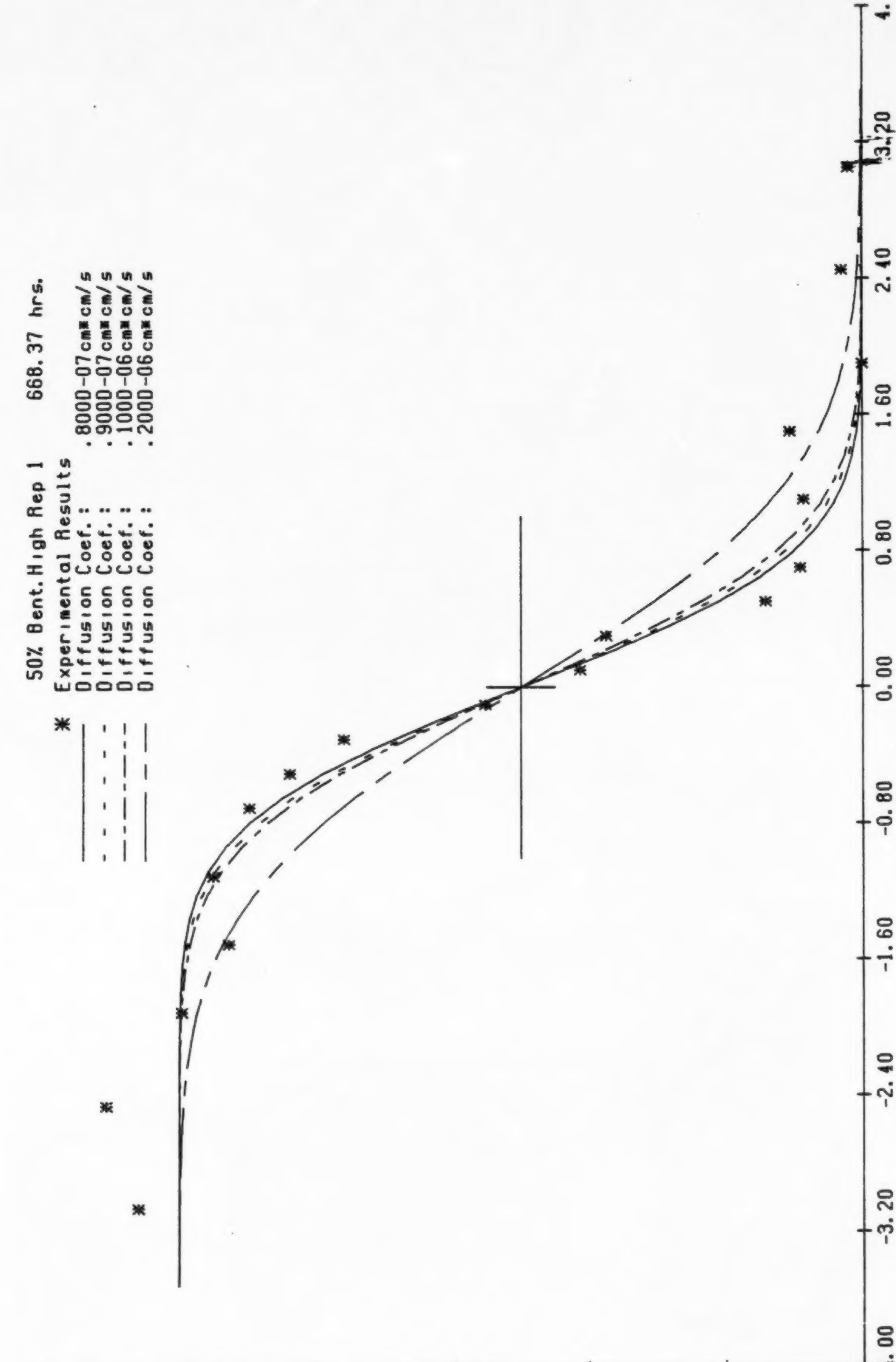

50% Bent. Low Rep 1 717.75 hrs.
Experimental Results
Diffusion Coef. : .6000-06cm*cm/s
Diffusion Coef. : .7000-06cm*cm/s
Diffusion Coef. : .8000-06cm*cm/s
Diffusion Coef. : .9000-06cm*cm/s
1.20
00
0.80
0.60
0.40
0.20
0.00
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

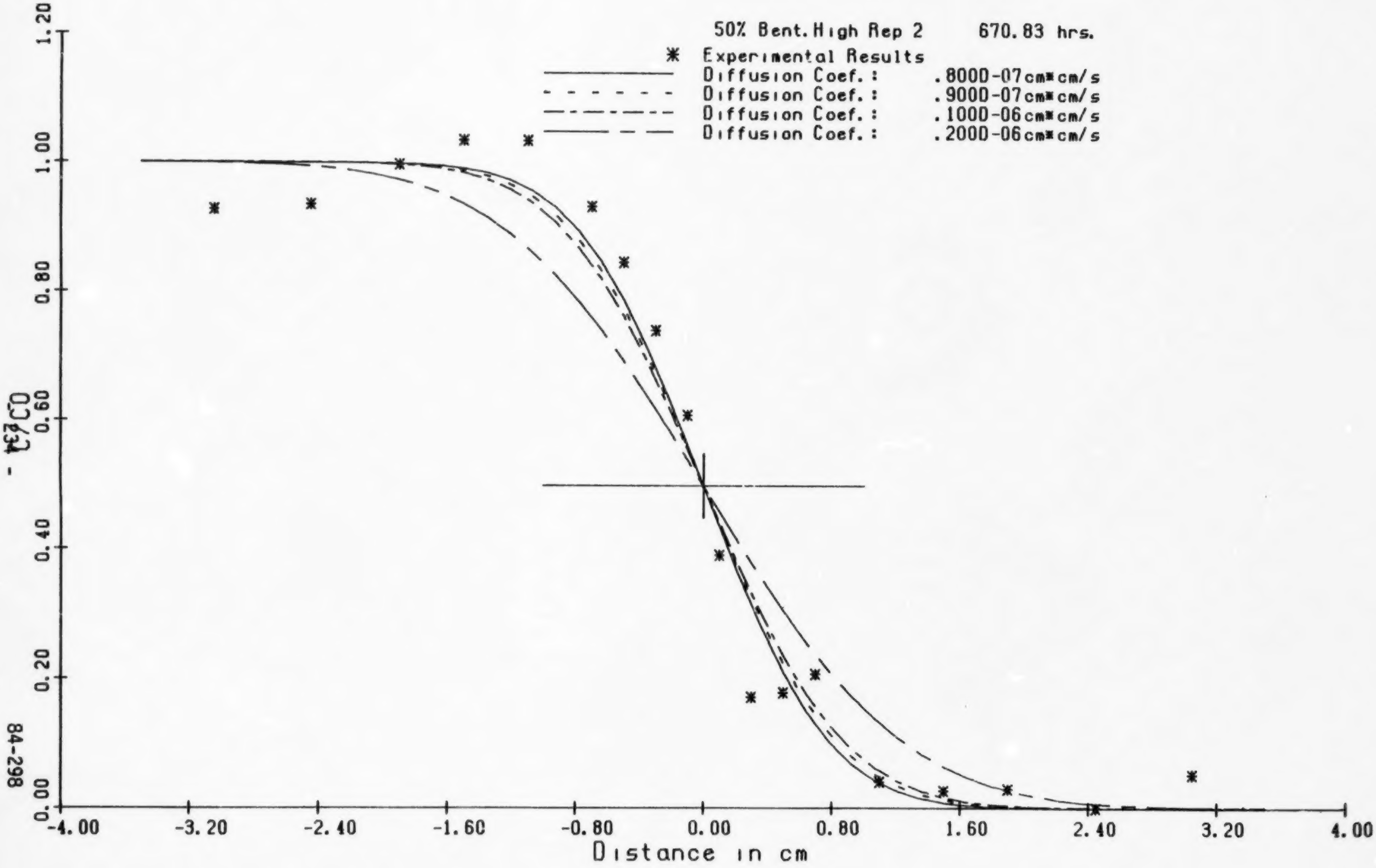

50% Bent.Low Rep 2 716.25 hrs.
✱ Experimental Results
Diffusion Coef. : .6000-06cm*cm/s
Diffusion Coef. : .7000-06cm*cm/s
Diffusion Coef. : .8000-06cm*cm/s
Diffusion Coef. : .9000-06cm*cm/s
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

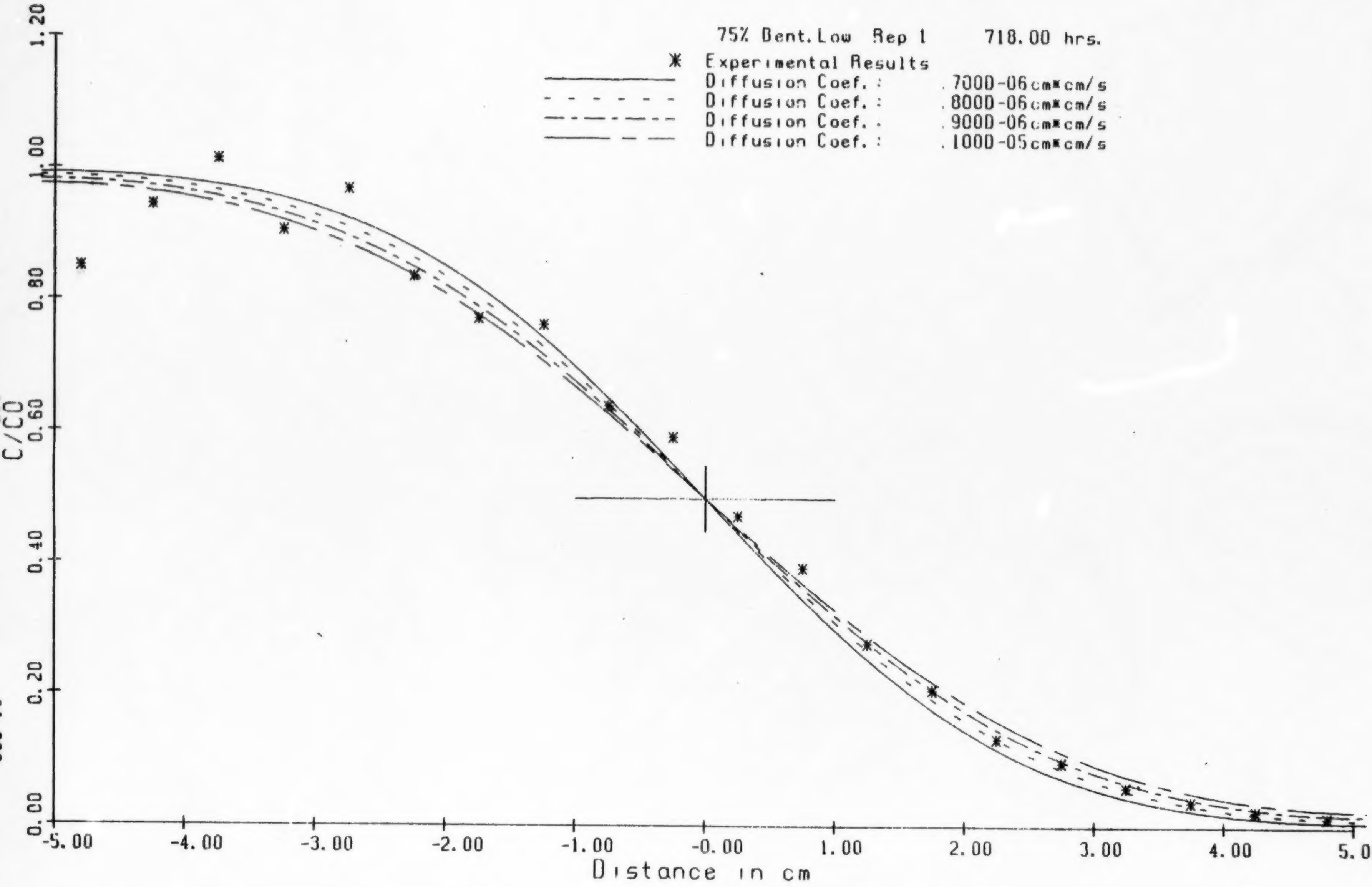

50% Bent. Med. Rep 1 935.50 hrs.
✱ Experimental Results
Diffusion Coef. : 2000-06cm*cm/s
Diffusion Coef. : .3000-06cm*cm/s
Diffusion Coef. : 4000-06cm*cm/s
Diffusion Coef. : .5000-06cm*cm/s
C/CO
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

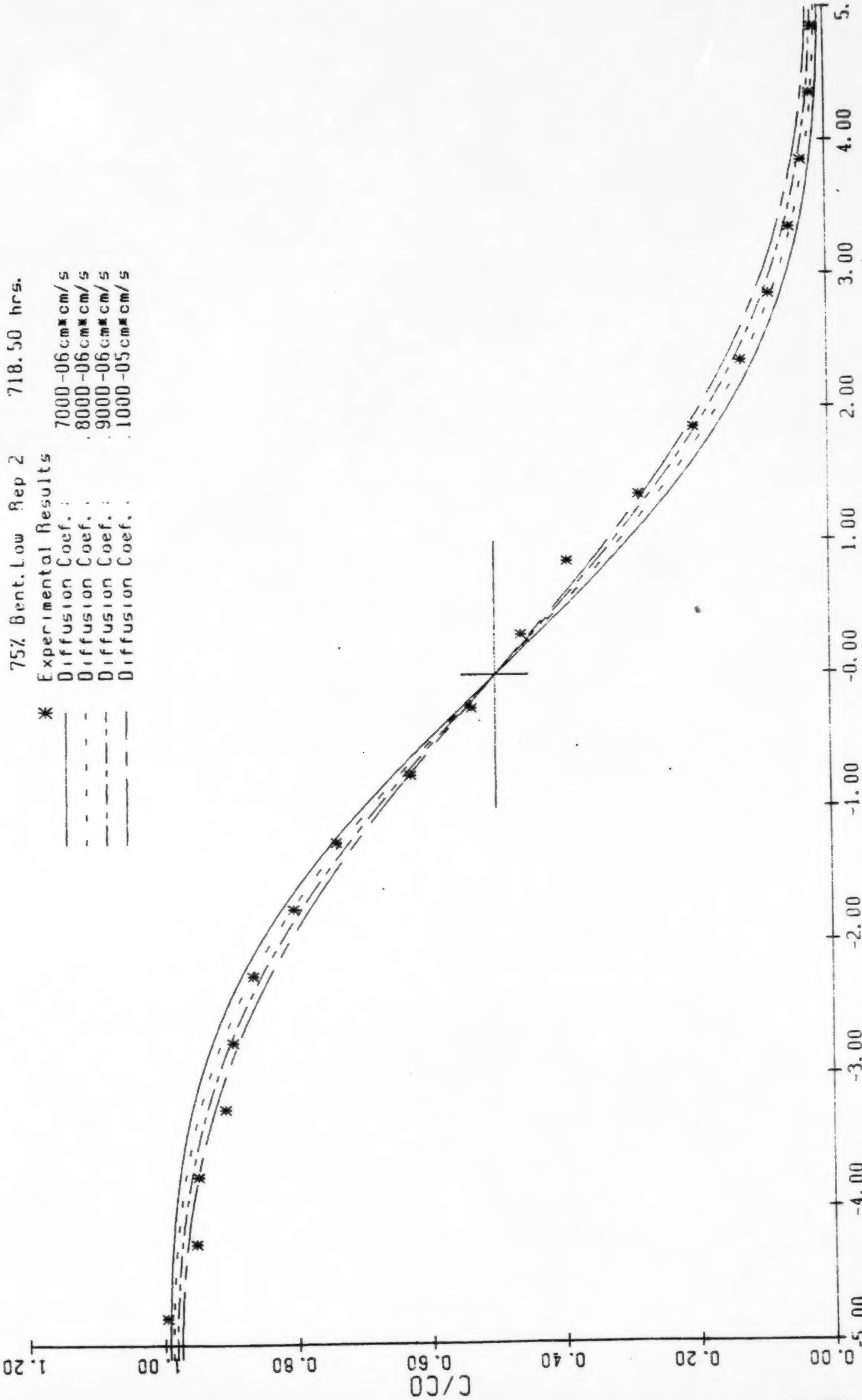

50% Bent.Med. Rep 2
936.25 hrs.
Experimental Results
Diffusion Coef.: .1000-06cm*cm/s
Diffusion Coef.: .2000-06cm*cm/s
Diffusion Coef.: .3000-06cm*cm/s
Diffusion Coef.: .4000-06cm*cm/s
Distance in cm
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
C232/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20

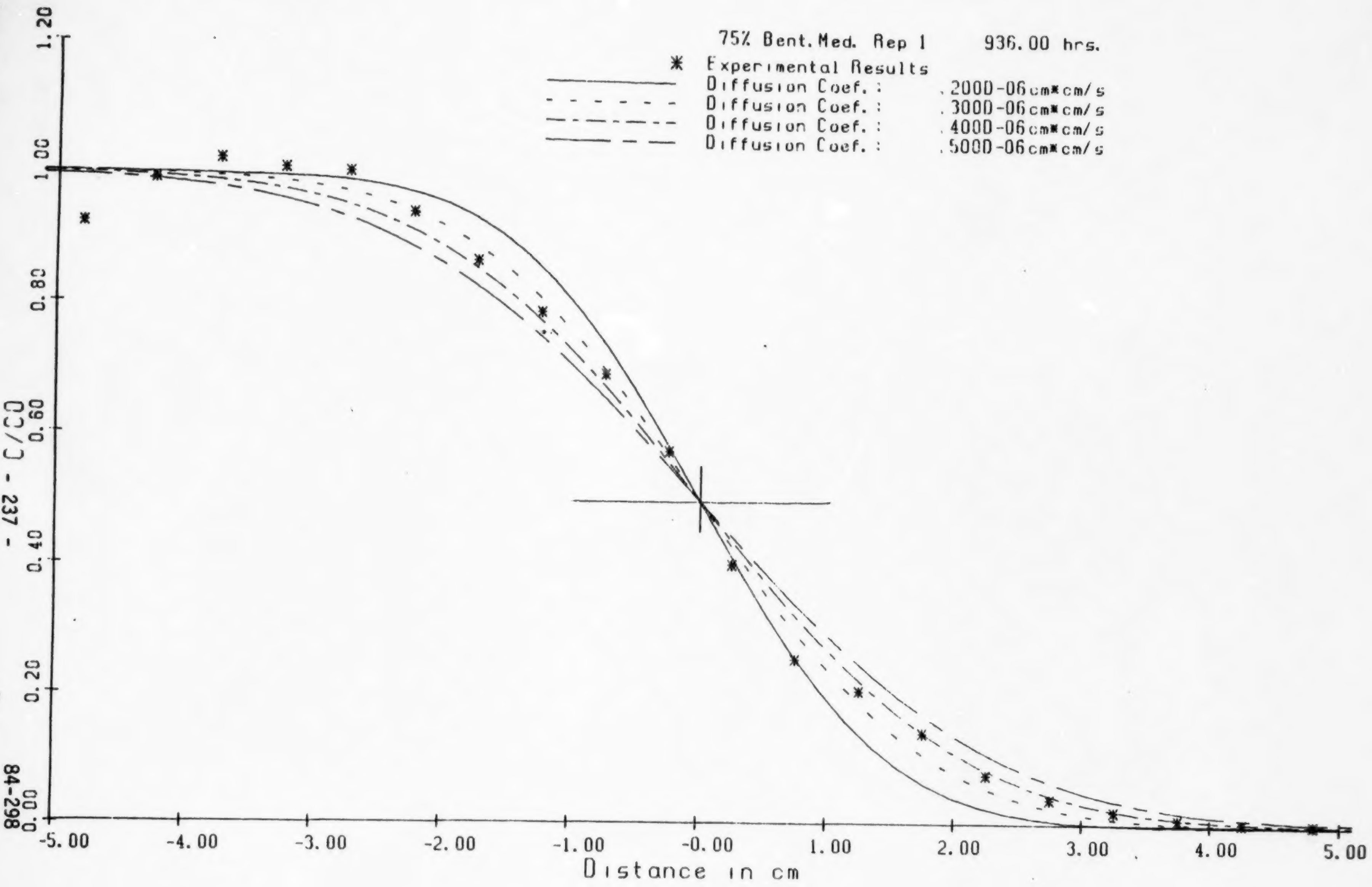
84-298

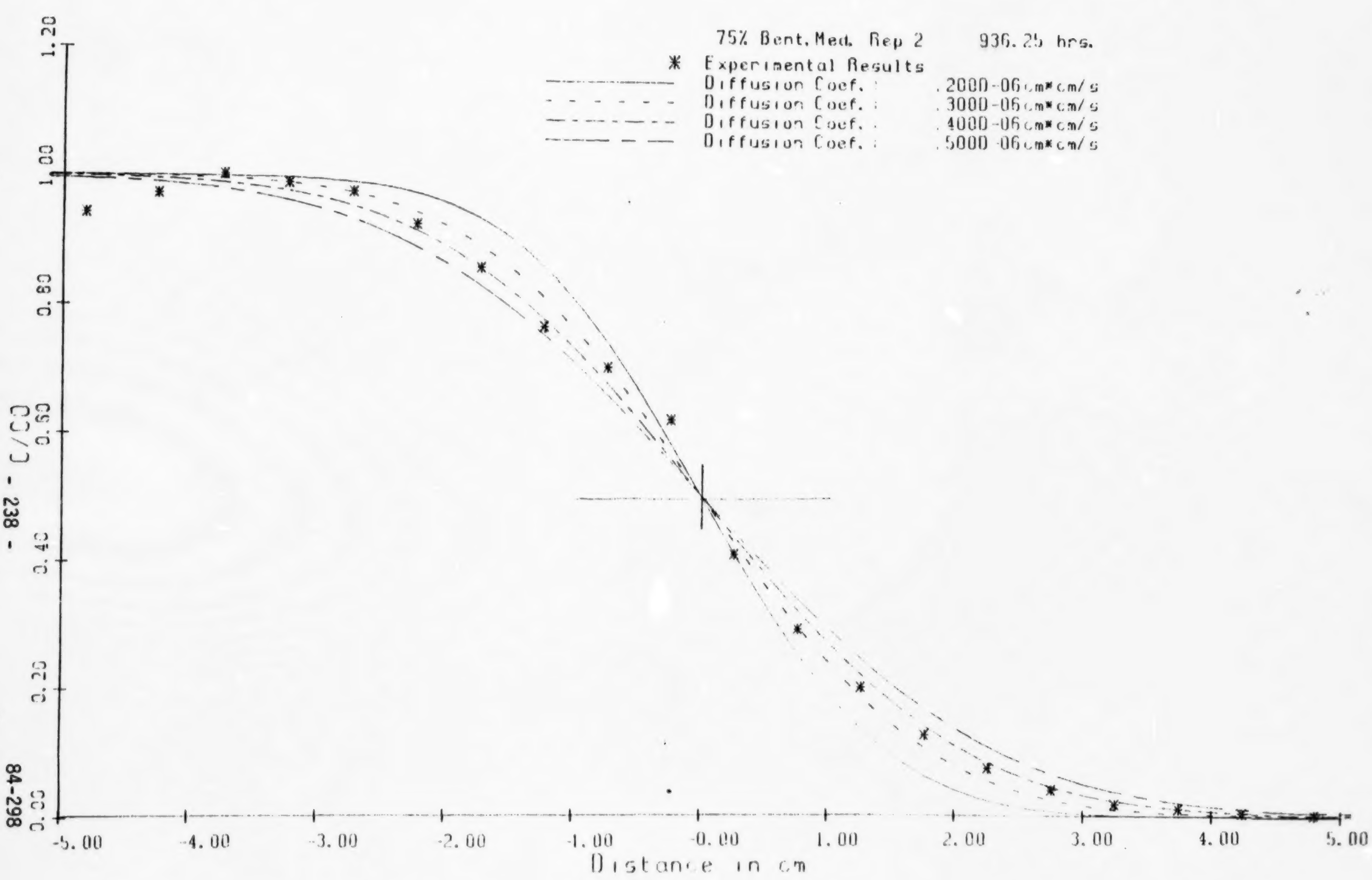

50% Bent.High Rep 1 668.37 hrs.
Experimental Results
Diffusion Coef. : .8000-07cm*cm/s
Diffusion Coef. : .9000-07cm*cm/s
Diffusion Coef. : .1000-06cm*cm/s
Diffusion Coef. : .2000-06cm*cm/s
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
Distance in cm
-4.00
-3.20
-2.40
-1.60
-0.80
0.00
0.80
1.60
2.40
3.20
4.

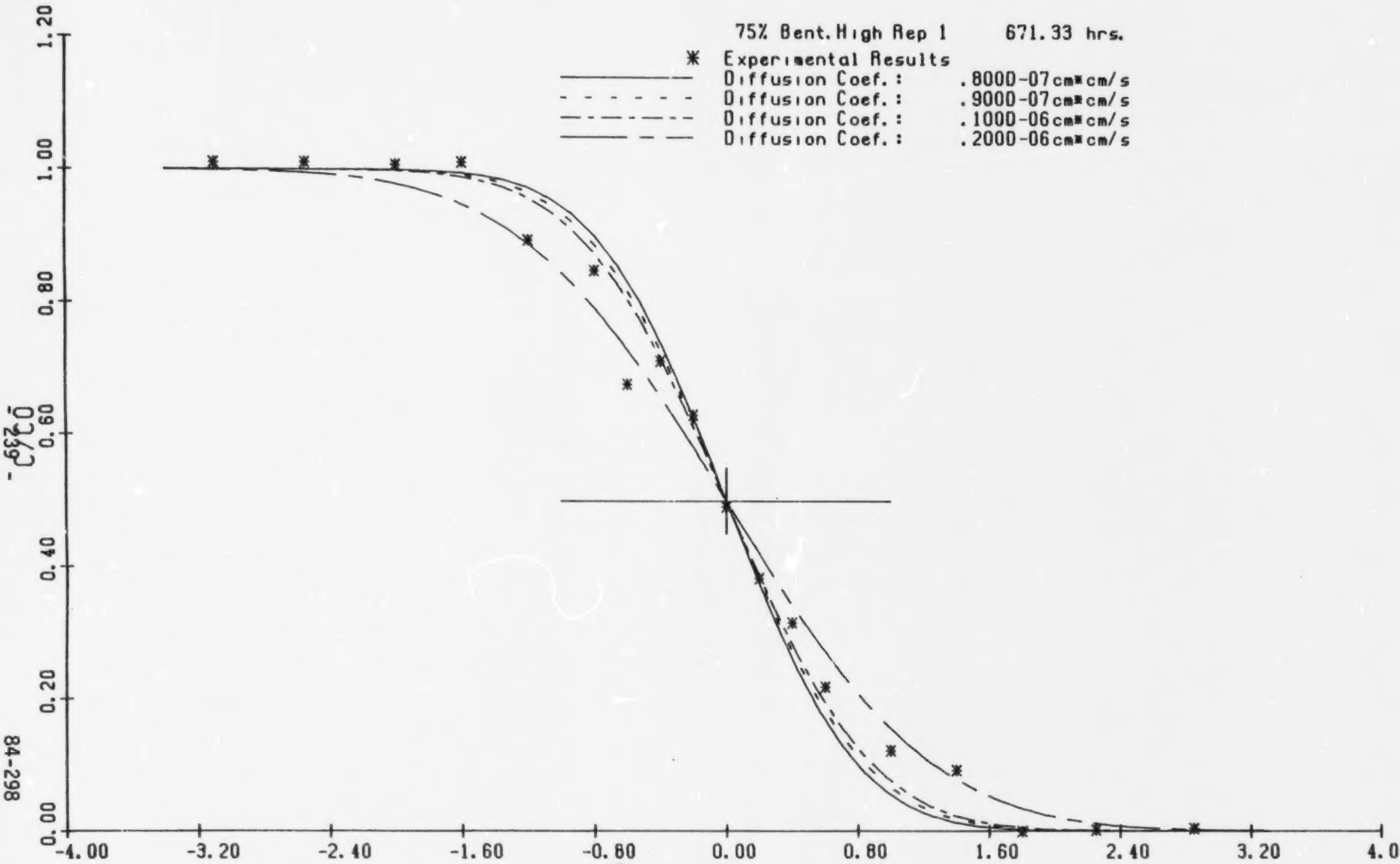

50% Bent.High Rep 2 670.83 hrs.
Experimental Results
Diffusion Coef.: .8000-07cm*cm/s
Diffusion Coef.: .9000-07cm*cm/s
Diffusion Coef.: .1000-06cm*cm/s
Diffusion Coef.: .2000-06cm*cm/s
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-4.00
-3.20
-2.40
-1.60
-0.80
0.00
0.80
1.60
2.40
3.20
4.00
Distance in cm

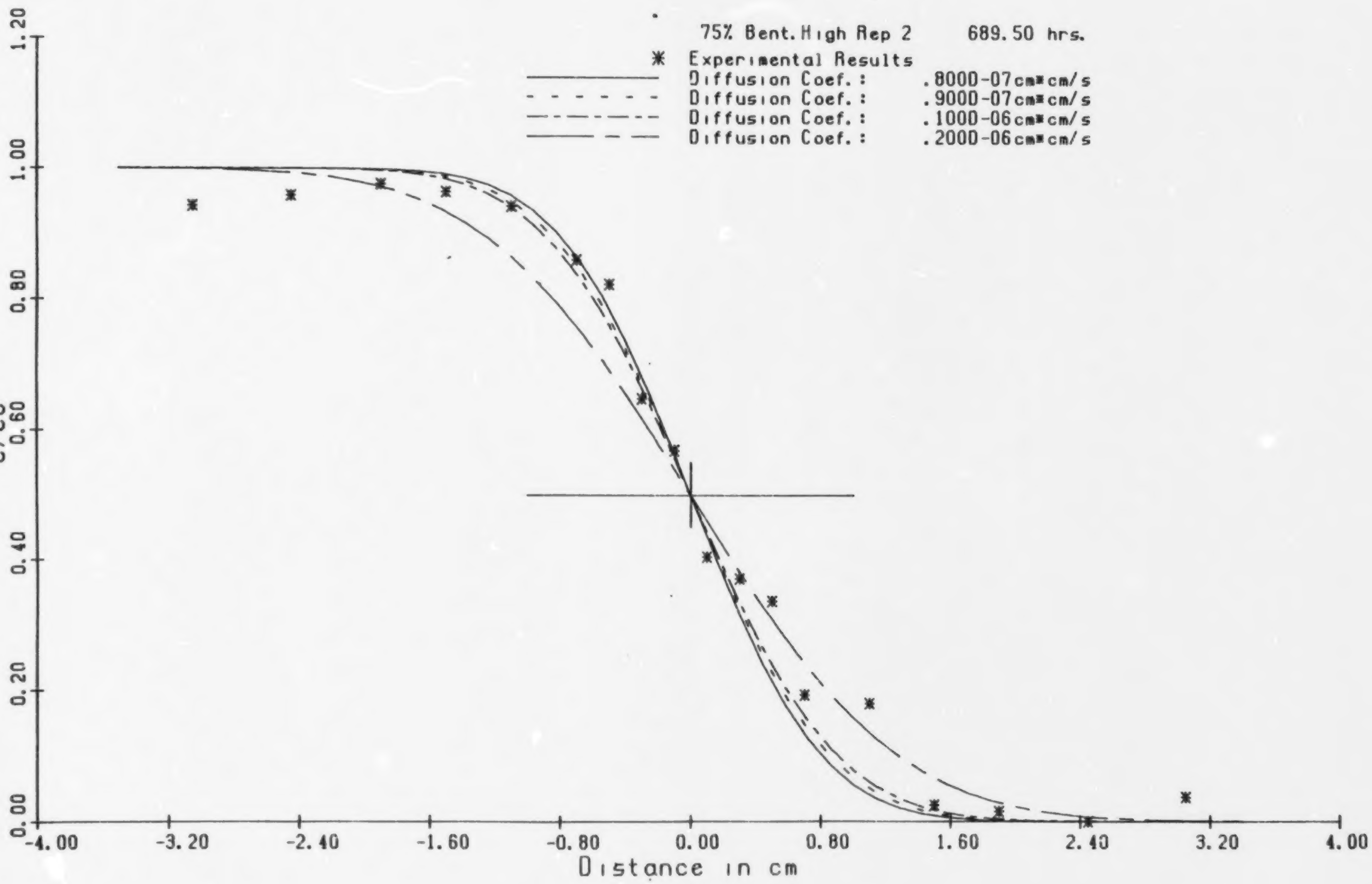

75% Bent.Low Rep 1 718.00 hrs.
* Experimental Results
Diffusion Coef. : .7000-06cm*cm/s
Diffusion Coef. : .8000-06cm*cm/s
Diffusion Coef. . .9000-06cm*cm/s
Diffusion Coef. : .1000-05cm*cm/s
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

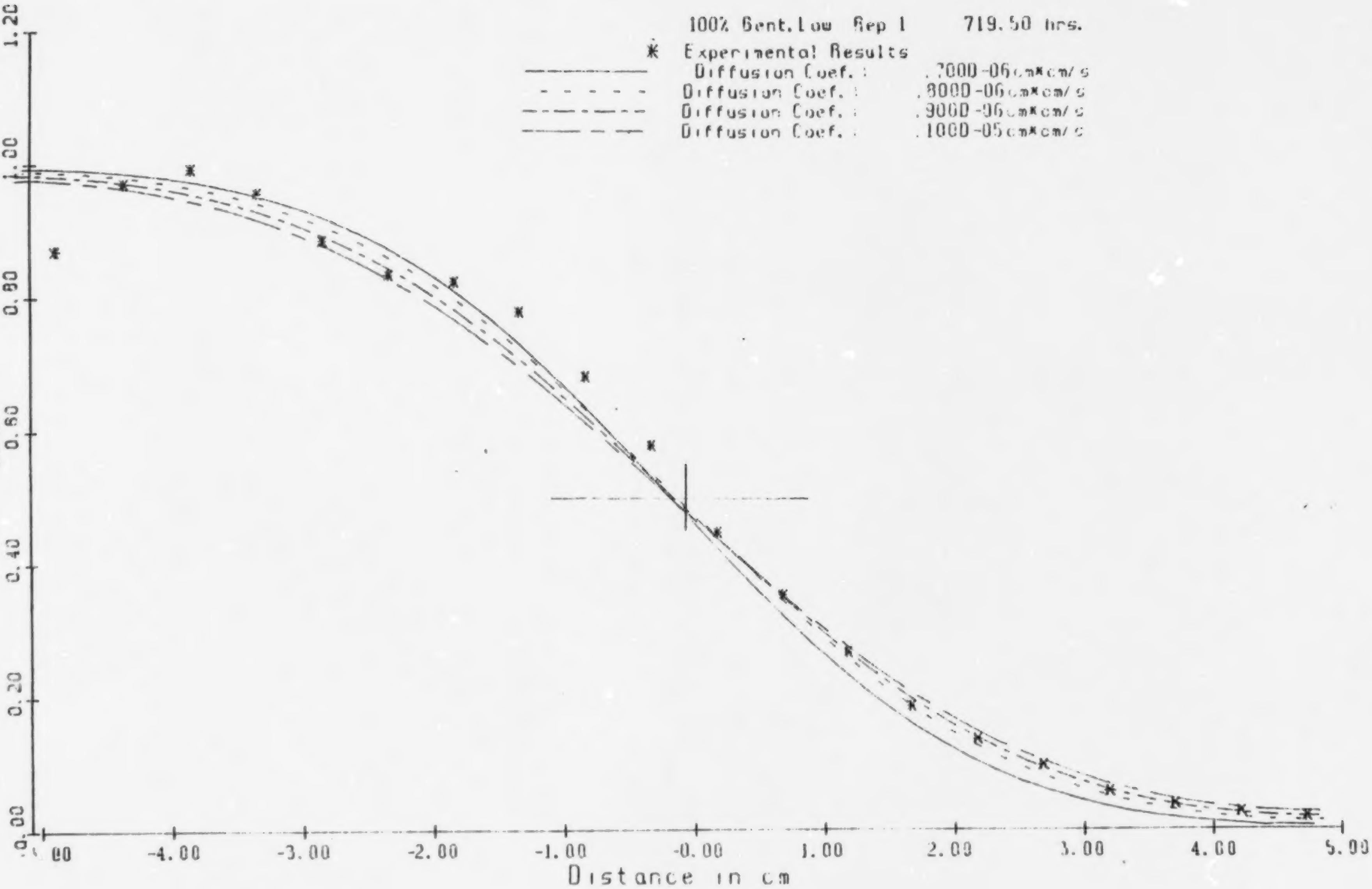
75% Bent.Low Rep 2 718.50 hrs.
* Experimental Results
Diffusion Coef. : 7000D-06cm*cm/s
Diffusion Coef. : .8000D-06cm*cm/s
Diffusion Coef. : .9000D-06cm*cm/s
Diffusion Coef. : .1000D-05cm*cm/s
C/CO
0.00
0.20
0.40
0.60
0.80
1.00
1.20
Distance in cm
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.

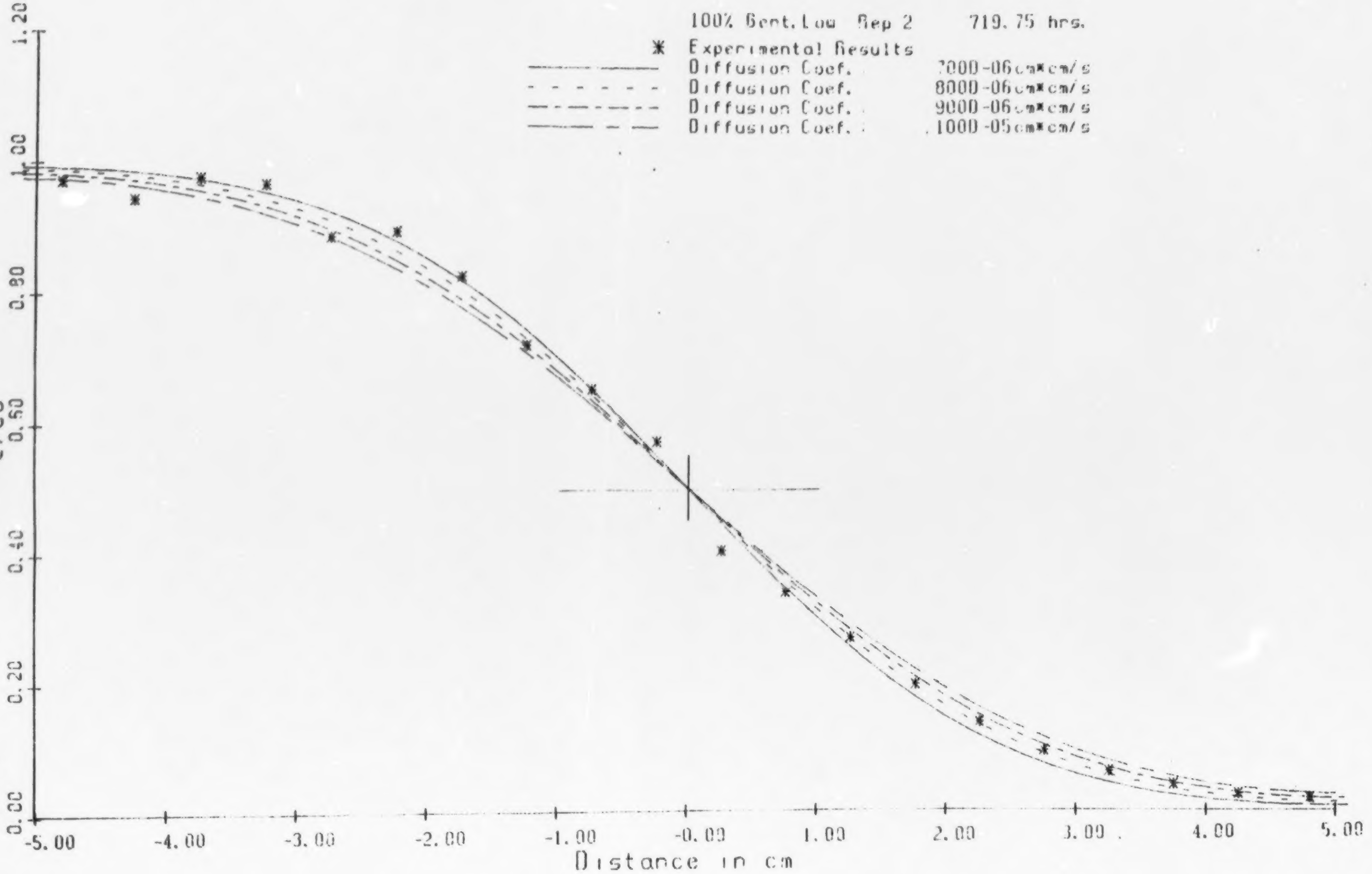

75% Bent.Med. Rep 1 936.00 hrs.
Experimental Results
Diffusion Coef. : .2000-06cm*cm/s
Diffusion Coef. : .3000-06cm*cm/s
Diffusion Coef. : .4000-06cm*cm/s
Diffusion Coef. : .5000-06cm*cm/s
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

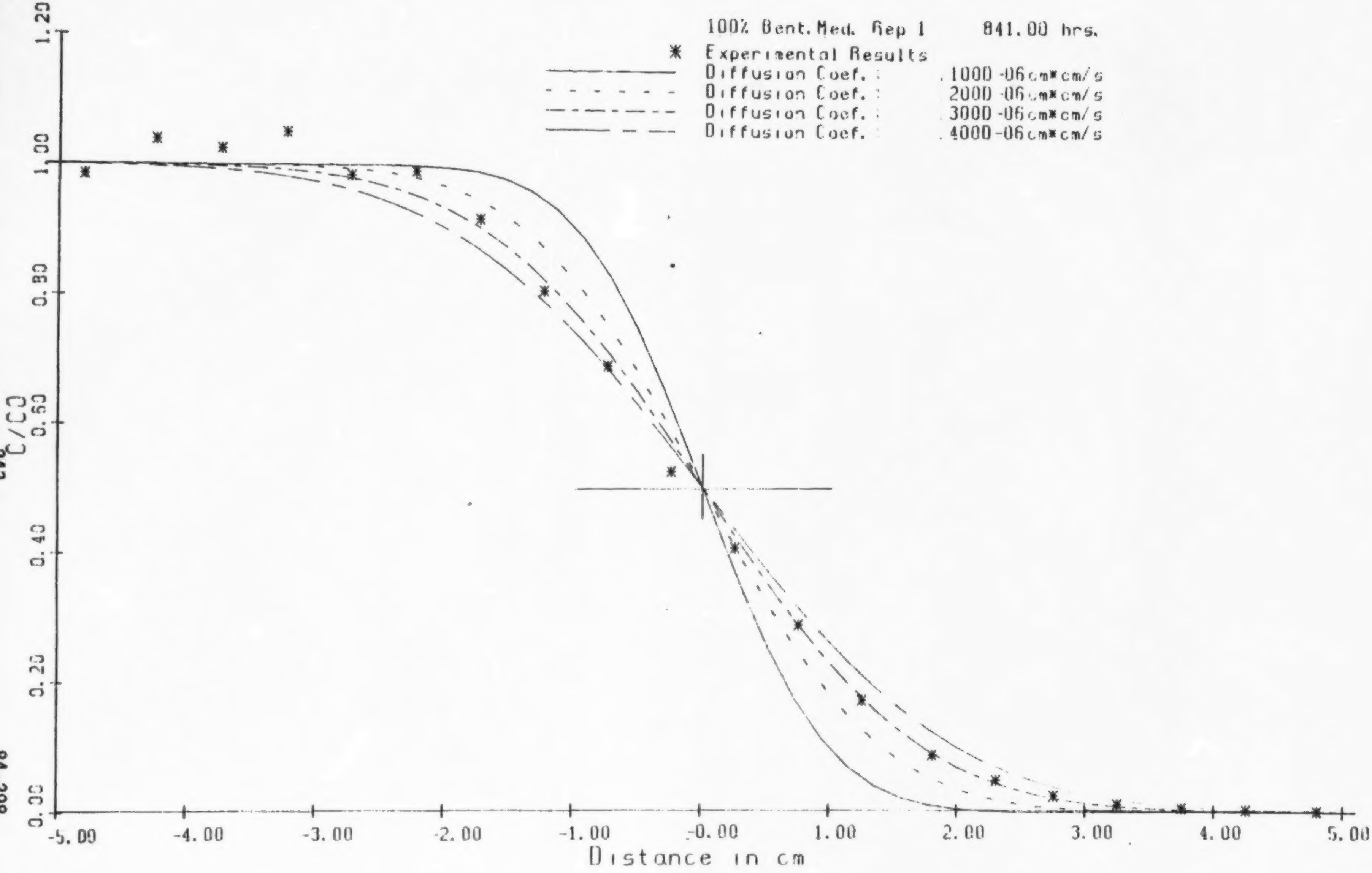

75% Bent. Med. Rep 2   936.25 hrs.
* Experimental Results
Diffusion Coef. : .2000-06 cm*cm/s
Diffusion Coef. : .3000-06 cm*cm/s
Diffusion Coef. : .4000-06 cm*cm/s
Diffusion Coef. : .5000-06 cm*cm/s
C/C0
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm

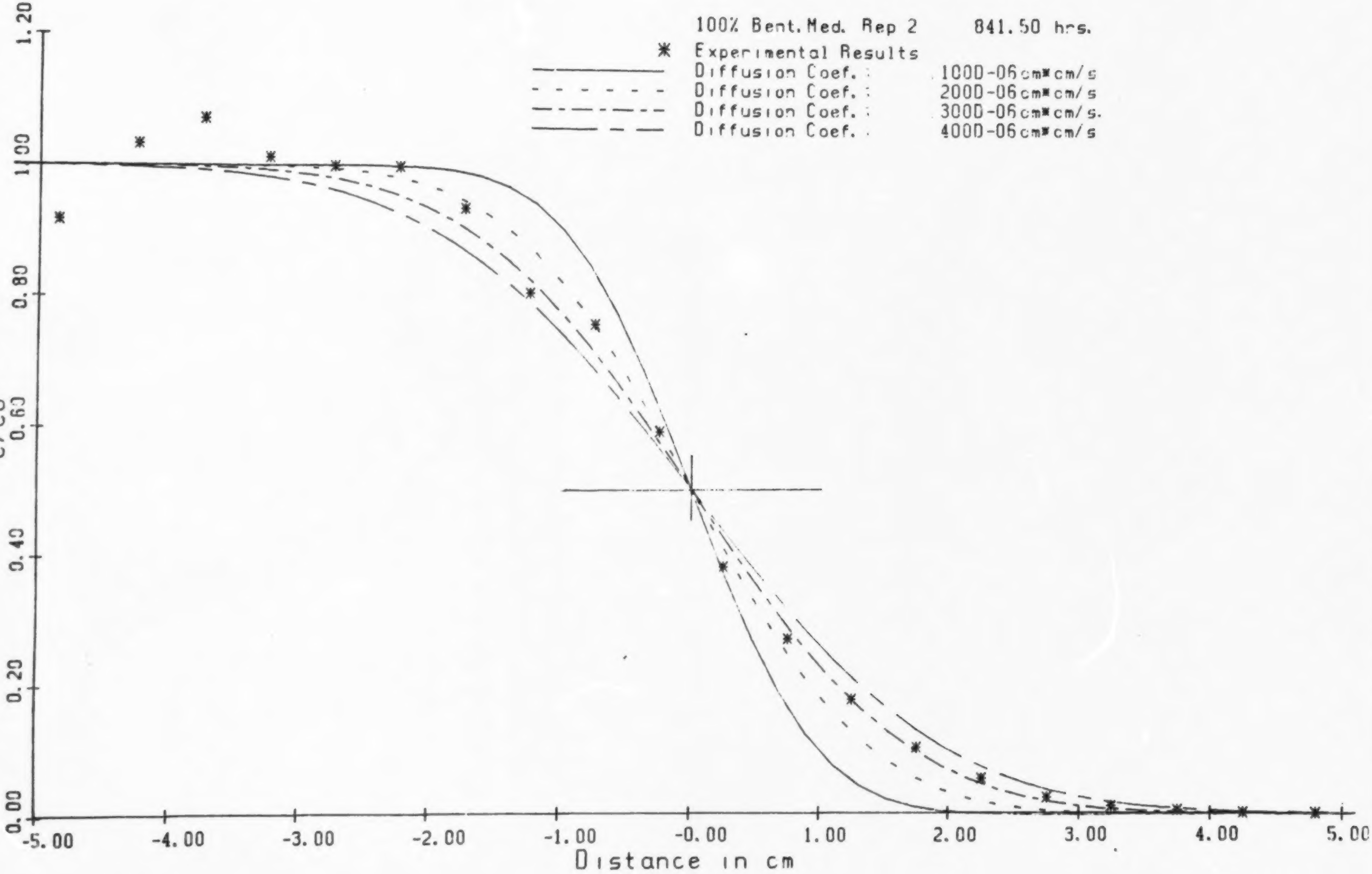

75% Bent.High Rep 1 671.33 hrs.
* Experimental Results
Diffusion Coef.: .8000-07cm*cm/s
Diffusion Coef.: .9000-07cm*cm/s
Diffusion Coef.: .1000-06cm*cm/s
Diffusion Coef.: .2000-06cm*cm/s
C/C0
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-4.00
-3.20
-2.40
-1.60
-0.80
0.00
0.80
1.60
2.40
3.20
4.0
Distance in cm

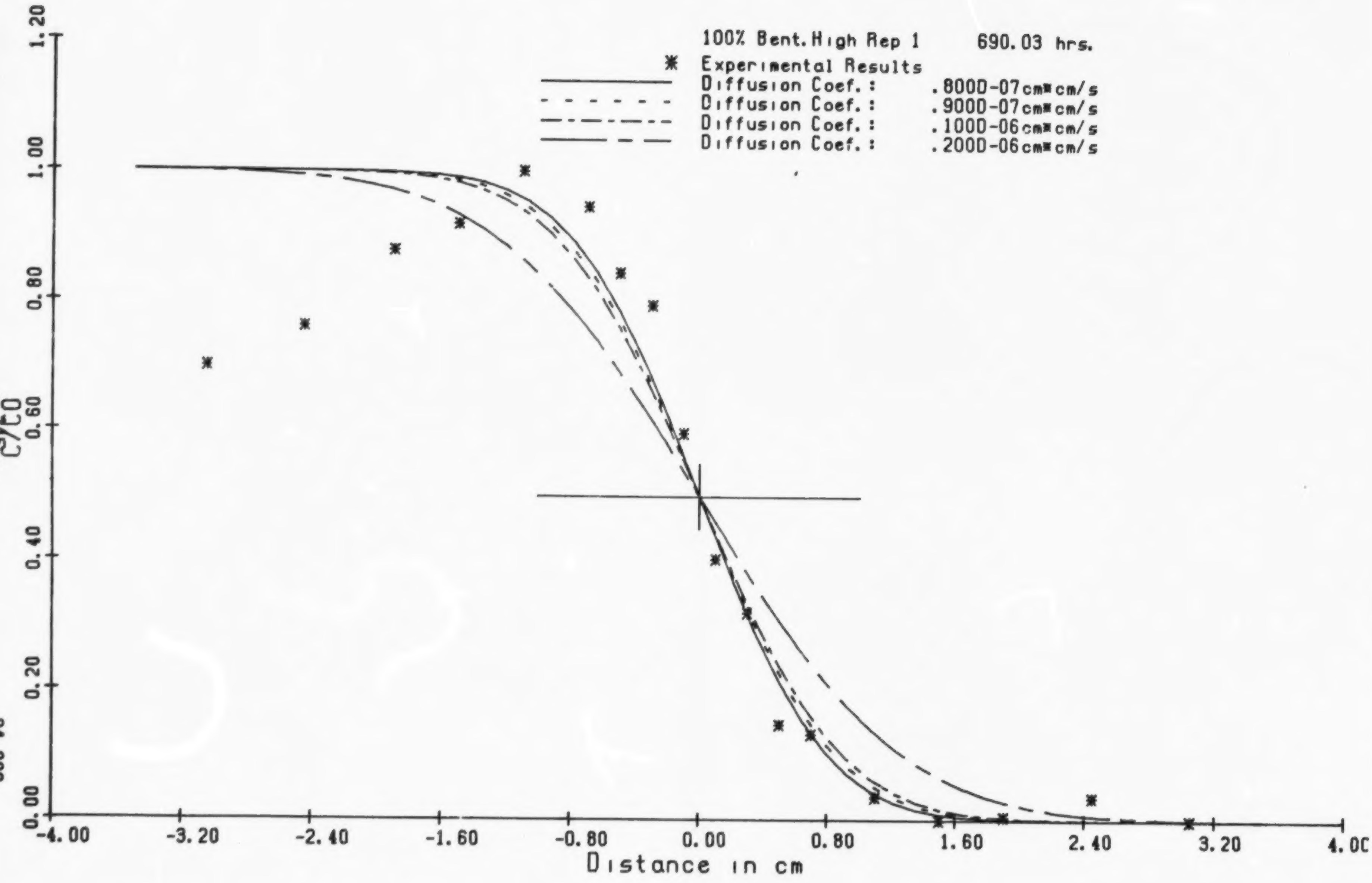

75% Bent. High Rep 2 689.50 hrs.
✱ Experimental Results
Diffusion Coef. : .8000-07cm*cm/s
Diffusion Coef. : .9000-07cm*cm/s
Diffusion Coef. : .1000-06cm*cm/s
Diffusion Coef. : .2000-06cm*cm/s
C/CO
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-4.00
-3.20
-2.40
-1.60
-0.80
0.00
0.80
1.60
2.40
3.20
4.00
Distance in cm

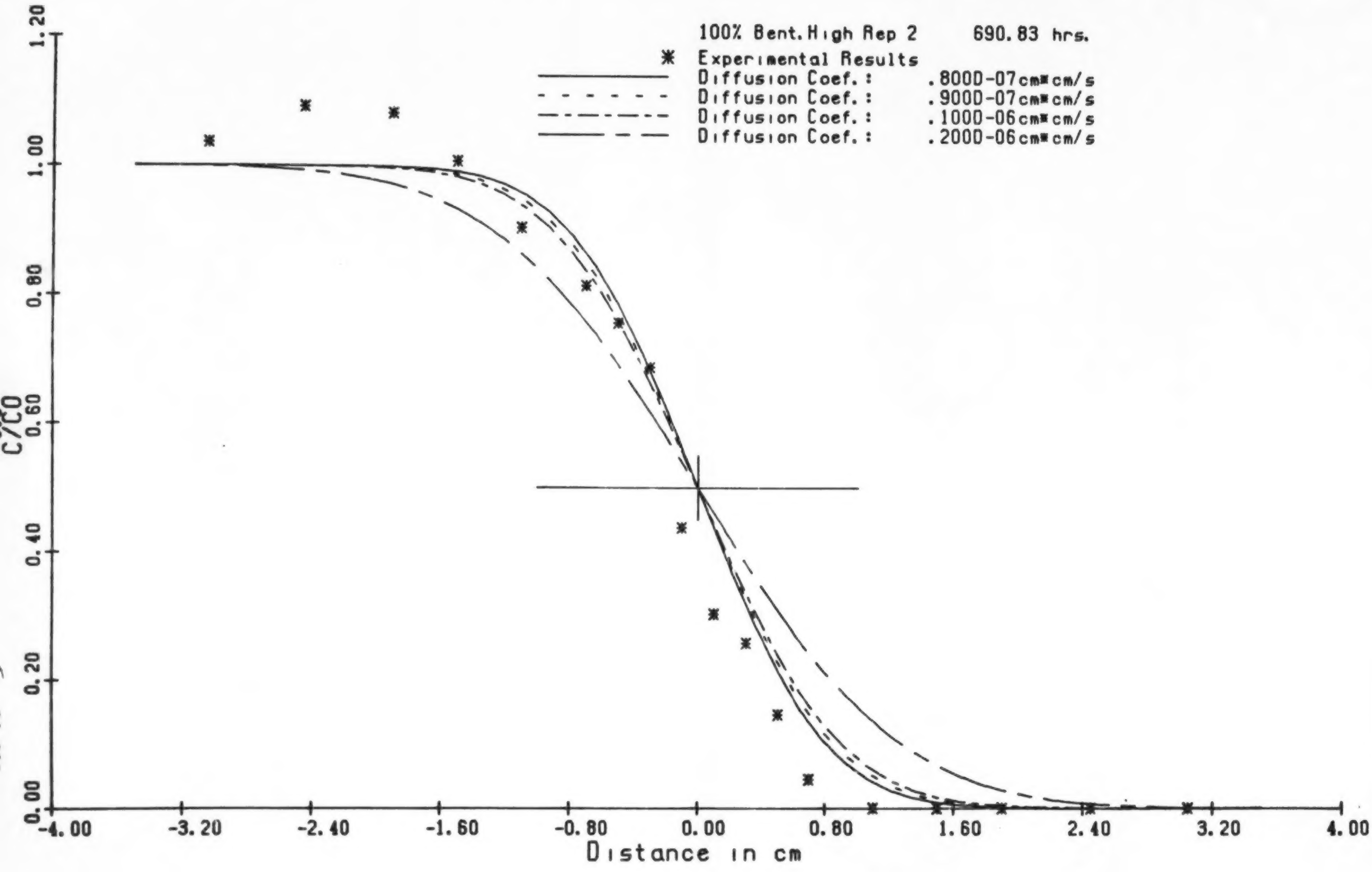

100% Bent.Low Rep 1 719.50 hrs.
Experimental Results
Diffusion Coef. : .7000-06cm*cm/s
Diffusion Coef. : .8000-06cm*cm/s
Diffusion Coef. : .9000-06cm*cm/s
Diffusion Coef. : .1000-05cm*cm/s
C/C0
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm


100% Gent.Low Rep 2 719.75 hrs.
Experimental Results
Diffusion Coef. .7000-06cm*cm/s
Diffusion Coef. .8000-06cm*cm/s
Diffusion Coef. .9000-06cm*cm/s
Diffusion Coef. .1000-05cm*cm/s
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm


100% Bent. Med. Rep 1 841.00 hrs.
* Experimental Results
Diffusion Coef. : .1000 -06cm*cm/s
Diffusion Coef. : .2000 -06cm*cm/s
Diffusion Coef. : .3000 -06cm*cm/s
Diffusion Coef. : .4000 -06cm*cm/s
C/C0
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm


100% Bent.Med. Rep 2
841.50 hrs.
Experimental Results
Diffusion Coef. : 1000-06cm*cm/s
Diffusion Coef. : 2000-06cm*cm/s
Diffusion Coef. : 3000-06cm*cm/s.
Diffusion Coef. : 4000-06cm*cm/s
C/C0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-5.00
-4.00
-3.00
-2.00
-1.00
-0.00
1.00
2.00
3.00
4.00
5.00
Distance in cm


100% Bent. High Rep 1 690.03 hrs.
Experimental Results
Diffusion Coef. : .8000-07cm*cm/s
Diffusion Coef. : .9000-07cm*cm/s
Diffusion Coef. : .1000-06cm*cm/s
Diffusion Coef. : .2000-06cm*cm/s
C/CO
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-4.00
-3.20
-2.40
-1.60
-0.80
0.00
0.80
1.60
2.40
3.20
4.00
Distance in cm


100% Bent.High Rep 2 690.83 hrs.
Experimental Results
Diffusion Coef.: .8000-07cm*cm/s
Diffusion Coef.: .9000-07cm*cm/s
Diffusion Coef.: .1000-06cm*cm/s
Diffusion Coef.: .2000-06cm*cm/s
C/CO
0.00
0.20
0.40
0.60
0.80
1.00
1.20
-4.00
-3.20
-2.40
-1.60
-0.80
0.00
0.80
1.60
2.40
3.20
4.00
Distance in cm

POOR

QUALITY

ORIGINAL